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3rd International Congress of Physical Medicine

IIIe Congres international de Medecine Physique

3° Congreso internacional de Medicina Fisica

3. internationaler Kongress für Physikalische Medizin

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The Vice President of the United States

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August 21-26, 1960

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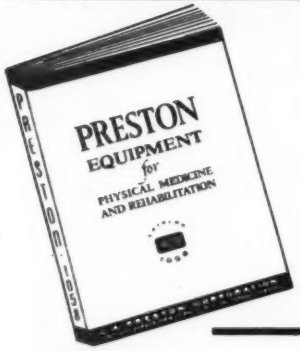

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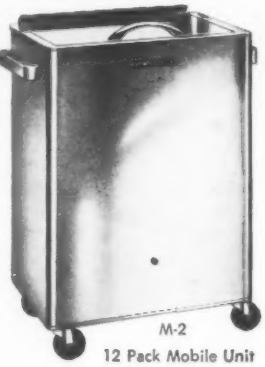

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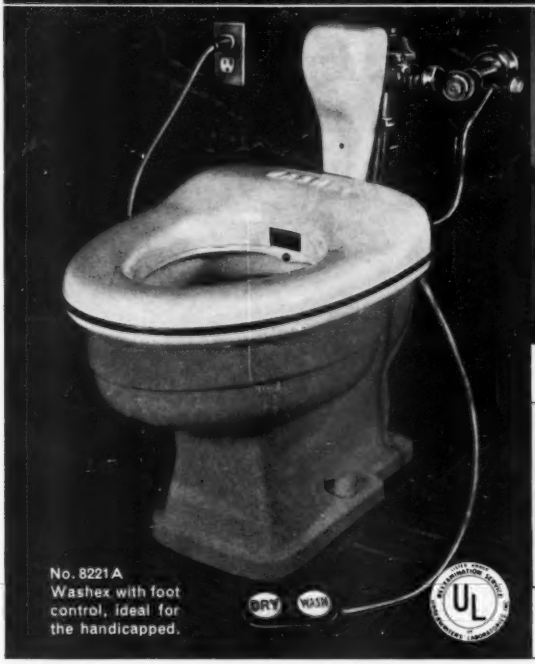

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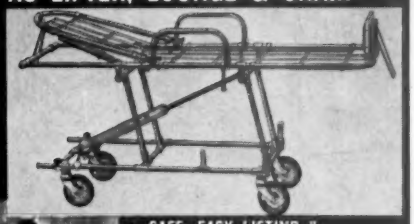

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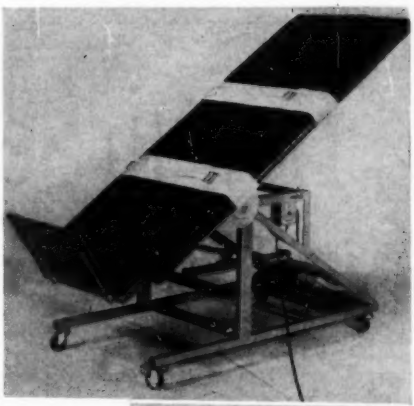

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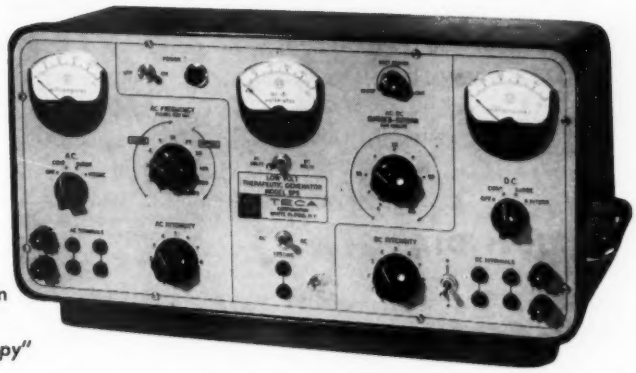

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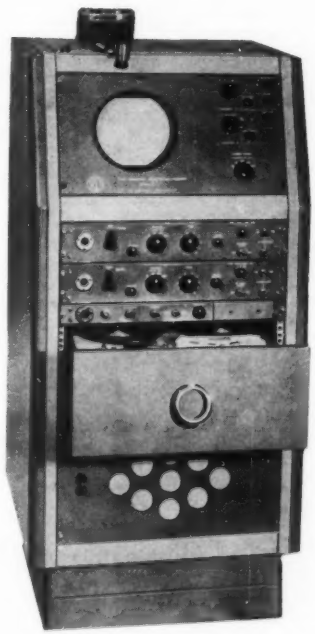

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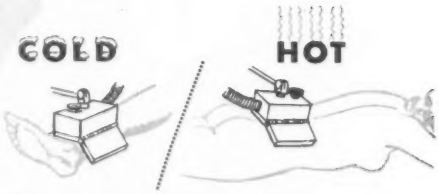

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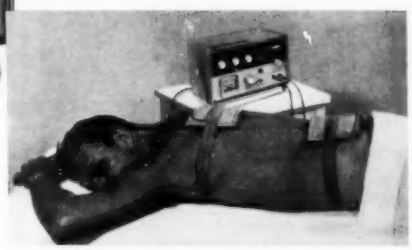

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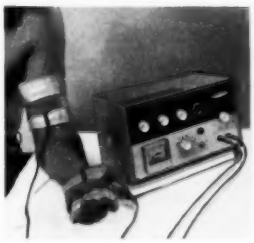

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Pulmonary Function Tests in Rehabilitation

Alfred W. Brody, M.D.
Omaha

● Uses of pulmonary function tests are described with relation to the physiologic subdivisions of the processes of respiration. The applications are described in detail for paralyzed patients undergoing rehabilitation. For contrast, typical findings in emphysema are presented.

The major purposes in modern medicine of the use of pulmonary function tests to measure the extent of respiratory disability have been described as: (1) to include or exclude disease with functional impairment, (2) to help evaluate the stage of a chronic disease in relation to its known history, (3) to help evaluate the degree of aid provided by procedures, (4) to evaluate reserve in relation to proposed surgery, and (5) to aid in clinical diagnosis of the difficult case by indicating a pattern of physiologic involvement.[1] The limitations are: (1) functional but not etiologic diagnosis is made, (2) anatomic diagnosis is not aided by the tests usually used, and (3) a battery of tests must be performed and the results must be interpreted in light of the clinical findings.

How does this apply to the problems of rehabilitation? The four basic processes involved in respiration are, from the physiologic point of view: (1) ventilation, the mass movement of gas into and out of the lung, (2) distribution of gas, the process whereby each of the hundreds of millions of alveoli receives its just apportionment of the ventilation in proper ratio to its volume and its blood supply, (3) diffusion, the process of random molecular movement whereby carbon dioxide leaves the blood and passes through the lung tissues into the immediately subjacent alveolar gas while oxygen simultaneously passes in the reverse direction from the alveolar gas to the blood, and (4) perfusion or the mass movement of blood into and out of the lungs. From the viewpoint of rehabilitation, it makes a great deal of difference which of these processes are interfered with and what the causes of that interference are.

A major group of the subjects seen for pulmonary function tests in rehabilitation are those whose respiratory disability is ventilatory, due to paralysis, and especially to disability of the lower motor neurones innervating the chest muscles and the diaphragm. In case of need these are the patients most benefited by long-term mechanical ventilation. In these subjects it is important to obtain a measure of the efficiency of the mechanics of ventilation. The usual direct tests of the mechanics of ventilation are the vital capacity, the maximal breathing capacity, and the measurement of maximal pressures.

Vital Capacity Tests

The technic of the one-stage vital capacity test is to have the patient perform a maximal inspiration and to measure the following maximal expiration. The two-stage vital capacity test has the advantage of distinguishing separately the degree of inspiratory and of expiratory muscle loss, and is, in addition, not so much affected by any tendency to gas trapping in pulmonary disease. In this test, the inspiratory capacity which is the maximal possible inspiration from the resting end-expiratory level is measured. It is added to the separately measured expiratory reserve volume which is the maximal possible expiration from the same point. Since the resting end-tidal level is the position of respiratory muscular relaxation, it is a stable starting point for measurements.

In this rehabilitation center, there has been ample confirmation of the finding by Ferris, Warren, and Beals,[2] that, in

From the Cardiopulmonary Laboratory and Respiratory and Rehabilitation Center, Creighton Memorial-St. Joseph's Hospital; Chair of Cardiovascular Research, Department of Medicine, Creighton University School of Medicine.

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chronic patients with paralysis, the vital capacity may be used to predict fairly closely the period of time the patient can remain free of respiratory assistance. These investigators used fatigue and the appearance of tachycardia to delimit these times. We have seen chronic tachycardia and footward or even right axis deviation of the frontal plane electrocardiogram in a number of patients who had disregarded (or not noticed) this fatigue and had gone unassisted substantially longer each day than is now recommended. These signs disappeared after a few nights or additional day periods of respiratory aid, and remained absent so long as the additional aid was continued. The periods of possible unassisted time indicated by vital capacity measurements are a few minutes to half hour for vital capacities of about 5 to 8 per cent of the predicted value, an hour or two for 10 per cent of the predicted vital capacity, increasing steadily in proportion to the vital capacity to about 15 hours at about 25 per cent of predicted. However, these patients usually are not able to sleep without aid unless their vital capacity is about a third of that predicted. These figures do not apply to the acute phases of disease or of superimposed diseases when fever and stress may lead to greater demands. Tracheotomy somewhat reduces the vital capacity needed.

Standards for vital capacity for adults are given in Baldwin, Cournand, and Richards;[3] for children by Ferris and co-workers.[4, 5] The maximal respiratory pressures the paralyzed subject can attain are reduced; the reduction is very much greater if a small (calibrated) leak is included in the apparatus used.[6]

Maximal Breathing Capacity Test

The maximal breathing capacity is the maximum amount the patient can voluntarily breathe, measured spirometrically during the best approximately 12-second period of a 30-second attempt. This is greater in normal subjects and in patients with lower motor paralysis or intrinsic lung disease than the ventilation produced by work or by stimulation with carbon dioxide.[7] The maximum breathing capacity is greatly reduced also in paralyzed subjects, approximately in proportion to the loss of respiratory reserve and the diminution in the vital capacity. However this test is very vigorous and fatiguing and may exhaust severely paralyzed patients for some hours or even longer. In our hands, it has added little to the understanding obtained from the vital capacity in these patients. Therefore we employ it but rarely in paralyzed patients. On the other hand, in intrinsic diseases of the lung such as emphysema, fibrosis, and asthma, this test is important.

Timed Vital Capacity

The timed vital capacity is a measure of forced and timed expiration that may be substituted for the maximal breathing capacity when the latter is too exhausting in such diseases. The timed vital capacity states what percentage of the patient's single-stage vital capacity may be expired in the first second, or in the first 3 seconds[8] of expiratory effort. Interestingly enough, the timed vital capacity is not abnormal in most patients with even severe ventilatory defects due to paralysis.[6]

In patients paralyzed because of poliomyelitis, a weekly or bimonthly charting of the vital capacity is of definite aid not only in recording any progress that has been made, but also in prognosis by extrapolation. Such a chart will give clear evidence of the amount of restriction due to acute supervening atelectasis, and the increase in vital capacity again as the atelectasis clears. Correlations with chest x-rays are good.

In paralyzed patients a measure of actual alveolar ventilation is very useful whether the patient is breathing unassisted or with ventilatory aid. In the latter case, such a measurement offers useful guidance in the adjustment of the apparatus. The best test for this purpose is the measurement of the partial pressure of carbon dioxide (PCO_2) in the end-tidal ("alveolar") expired gas, using an infrared carbon dioxide analyzer which permits repeated rapid breath-to-breath analysis. In patients with small or no right-to-left shunts, this measurement re-

flects mainly the efficacy of the ventilation. Normal levels in males are about 39-44 mm. Hg; in females, 33-38. However, the use of respiratory aids greatly affects the levels that patients and normal subjects[9] find comfortable. The usual end-tidal PCO_2 of subjects in a chest shell is about 25-30 mm. Hg for females and 30-35 for males. In the "iron lung," subjects are usually not comfortable unless the carbon dioxide has declined to 20 or 25 mm. Hg.

Oxygen Saturation

Measurement of oxygen saturation by ear oximetry usually accompanies use of the foregoing technic and furnishes a measure of over-all respiratory exchange. Parenchymal disorders of the lung involving such processes as diffusion and blood shunting occur in paralyzed patients only as a complication, usually atelectasis. Since oxygen exchange unlike that of carbon dioxide is very sensitive to shunts as well as to diffusion defects in the lung, the oxygen saturation of blood may be decreased although the carbon dioxide tension in that same arterial blood is normal. If the right-to-left blood shunt is due to the blood flow through a lung segment that is atelectatic, the alveolar gas is not in contact with all of the blood. If mixed arterial blood has a normal carbon dioxide tension, then the portion coming from the atelectatic lobes must have a higher-than-normal tension, since no carbon dioxide was lost from this portion; and the blood coming from the aerated remainder of the lung must have a lower carbon dioxide tension than normal. In other words, the average alveolar gas, and therefore the end-tidal, will be low in its carbon dioxide content. This is actually due to hyperventilation in response to the anoxia. This then is when low oxygen saturation and low end-tidal carbon dioxide tensions are seen together. With such patients, already the victims of atelectasis, usually as a result of excessive secretion and upper respiratory and bronchial inflammation, therapy with high concentrations of oxygen carries considerable risk of further atelectasis. Routine daily oximetry proves that the unsaturation due to atelectasis is usually brief. It lasts only a few hours to a few days, and disappears, while atelectasis is still complete as seen by x-ray. Whatever the arguments about mechanism, it is clear that some local process cuts off blood flow locally when aeration ceases.

Additional Parenchymal Disease

Occasionally with paralyzed patients it is desirable to determine whether there is additional parenchymal disease of the lung. With the ventilation kept normal or slightly raised, desaturation as mentioned previously indicates fairly severe lung damage; but lower degrees of parenchymal dysfunction may often be detected by measurements of gas distribution within the lungs. Poor gas distribution within the lungs indicates poor efficiency of renewal of the alveolar gas. If a subject is given pure oxygen to breathe, the normal individual has less than 2 per cent nitrogen left in his lungs and expired air at 7 minutes; the patient with poor gas distribution has more.[3] If the normal subject is given a single deep breath of oxygen, the gas is well mixed in the alveoli and the concentration of nitrogen early in the next expiration is within 2.5 per cent of that late in the same expiration.[10] Or a "time to equilibrium" measurement may be made during rebreathing of a definite quantity of oxygen through a carbon dioxide absorber.[11] Equilibrium is defined as the point when the nitrogen concentration of inspired gas reaches within defined limits of that of the expired gas. Other inert gases may be used in such measurements.

Measurement of the residual volume, especially as a per cent of the total lung capacity, does not reflect parenchymal disease when paralysis is present. In the extreme case of complete paralysis, even without parenchymal disease, the total lung capacity only equals the residual volume (that is: residual volume ÷ total lung capacity = 100 per cent). The functional residual capacity in liters may be of some use since it is usually normal or slightly decreased in paralysis, and is usually, though not always, high in emphysema.

Table 1: Useful Pulmonary Function Tests in Respiratory Paralysis and Emphysema*

Test	Normal	Paralysis	Emphysema
Measurements of ventilation (without aid):			
Vital capacity (+ subdivisions) (L)	3.85	↙↙	N.C. or ↙
Maximal breathing capacity (L/min.)	115	↙↙	↙↙
Timed vital capacity (1 sec.)	> 82%	N.C.	↙↙
Maximal pressures (+ leak) (mm. Hg)	> 35	↙↙	N.C.†
Measurements of hyperinflation and gas distribution:			
Functional residual capacity	< 63%	↗↗	↗↗
or residual volume as per cent T.L.C.	< 38%	↗↗	↗↗‡
Functional residual capacity (L)	< 4.0	N.C. or ↙	↗↗‡
7-Minute O_2 washout (Cournand)	< 2% N_2	N.C.	↗ or ↗↗
Single breath of O_2 (Fowler)	< 2.5%	N.C.	↗ or ↗↗
Time to equilibrium (9 L spiro) (min.)	to 3.5	N.C.	↗ or ↗↗
Measurements of diffusion:			
CD methods (cc/min./mm. Hg)	25	N.C.	↙ to ↙↙
O_2 saturation on exercise	98%	N.C.	N.C. to ↙↙
Measurements of perfusion:			
Shunts by 100 per cent O_2 (or dye dilution)	10%	N.C.	↗ to ↗↗
Right heart "strain"-clinic, EKG, catheter, etc.	Normal	N.C.	N.C. to ↗↗
Over-all or "net" effects:			
End-tidal CO_2 (mm. Hg)	35-45	N. C. or ↙	N.C. to ↗
Equilibrated alveolar CO_2 or blood PCO_2 (mm. Hg)	43-50	N. C. or ↙	↗ to ↗↗
O_2 saturation (oximetry or Van Slyke)	97.5%	N.C.	N.C. or ↙

*The normal values indicated are for a 5-foot, 10-inch, 170-lb., 50-year-old male (see text for references for standards). Most of the paralyzed (lower motor neurone) patients seen are younger; most emphysematous patients older. The patients are assumed to be moderately to markedly affected, but with adequate ventilatory aid as needed for the paralyzed patient; (†) usually, however some mild abnormality is occasionally seen. (‡) Most but not all patients with emphysema exhibit fairly marked hyperinflation (see text). N.C. = no change, ↗ = increased, ↙ = decreased.

Findings in Paralysis and Emphysema

All of these findings in the paralyzed patient are listed in table 1. The normal figures there are listed for a male of particular size and age; the dependence of "normal" standards on these factors should be emphasized. For contrast, table 1 indicates the type of change seen in the most common type of intrinsic disease of the lungs, namely emphysema. Much the same pulmonary function changes would be seen in silicosis, or in asthma during an attack or, if there were residuals, between attacks. In these diseases, in contrast to paralysis, the maximal breathing capacity or the timed vital capacity, and the measures of gas distribution, may often best indicate the malfunction in moderate to marked disease. As the disease advances to more severe stages, the diffusion defects, shunts, and evidence of right heart strain become progressively more serious and important. Retesting at intervals of 6 months or a year may be advisable in following subjects with relatively stationary disease; more frequent retests may be needed during progressive phases or with active therapy.

Summary

The uses of pulmonary function tests are described with relation to the physiologic subdivisions of the processes of respiration. The applications are described in detail for paralyzed patients undergoing rehabilitation. For contrast typical findings in emphysema are presented.

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Basic Anatomy and Neurophysiology of Speech and Language

George Kelemen, M.D.
Boston

● Throughout lifelong evolution, anatomical changes remain in very close relation with the quantity and quality of the vocal output. To the changes occurring in the larynx itself, those appearing in the resonating tube have to be added. Growth around the oral, pharyngeal and nasal-paranasal cavities influence the vocal production. They add to its definite and individual character in such a far-reaching manner that single persons are in general easily identified merely by listening to their speech. Vocal individuality is reached by evolution, different for each person, of the profiles of cavities which make up the resonating tube. The larynx is the source of the sound, but it is not to be considered as the organ of speech. It produces the raw material in the form of sound which is modified into voice by resonating chambers located above and below the larynx. To become speech, collaboration of the pharynx, tongue, palate, lips, and nasal cavity is necessary. It may be permissible to throw a glance in the direction of the future of laryngeal development and ask if the human vocal cord and its productions were not overshot in some other species.

Anatomic Considerations

From the viewpoint of rehabilitation, one of the most important anatomical factors to keep in mind is that the infant larynx should not be considered a miniature edition of the adult larynx. Position, consistency, and shape require different planning depending on whether one deals with conditions arising in childhood or in mature age.

The descent of the larynx results in an angulation of the airway which considerably lessens the volume of air that could pass through a straight tube of equal caliber.

Along with the growth of the larynx and its descent to its adult position, mutations take place at puberty and at senescence as effects of endocrine changes. Change in pitch must occur when the vocal cords become longer at puberty: 1 cm. in boys, 3 to 4 mm. in girls.

Adjustment of the larynx to a new state of tension and contour, in order to produce a particular tone at a specified degree of loudness, is a highly integrated procedure. Time and practice are required to adjust to the changed anatomical situation, with its very different structural characteristics.

At the other end of evolution stands the aging larynx. Here, the outstanding features are ossification and calcification in the cartilages. Processes of atrophy enter the muscles and the mucosa, with loss of elastic tissue. The voice becomes higher and tremulous.

The character of the mucosa under such changes is of outstanding importance. In the embryo the larynx is lined by a cuboidal epithelium which, in postnatal life, gives place to two different kinds. The greater part of the larynx is covered by respiratory, cylindrical epithelium, arranged in layers. But where the opposite areas come in contact during valvular action, a more resistant stratified squamous epithelium is found, as on the free border of the vocal cord and of the ventricular bands. Amid the ciliated epithelium, islets of the squamous type can be found, a circumstance of outstanding interest when pathological changes are considered.

Throughout the lifelong evolution, anatomical changes remain in very close relation with the quantity and quality of the vocal output. To the changes occurring in the larynx itself, those appearing in the resonating tube have to be added. Growth around the oral, pharyngeal and nasal-paranasal cavities influence the vocal production. They add to its definite

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From the Department of Otolaryngology, Harvard Medical School; Research Associate, Massachusetts Eye and Ear Infirmary.

This study was aided by a grant from the Wenner Gren-Foundation for Anthropological Research.

and individual character in such a far-reaching manner that single persons are generally easily identified merely by listening to their speech. Vocal individuality is reached by evolution, different for each person, of the profiles of cavities which make up the resonating tube.

Proceeding with anatomical considerations, the structures which underlie the sphincter mechanism must be considered. Along the evolutionary scale, the simple girdle around the laryngeal orifice differentiates into three tiers of muscles. All three are capable of separating an upper from a lower part of the respiratory apparatus, but all three have their particular functions. The three tiers are located one above the other.

The highest is at the level of the aryepiglottic folds, at the superior inlet of the larynx. The aryepiglottic folds are broad, with some muscular content (the aryepiglotticus); the incorporated cartilages of Wrisberg add rigidity. When the folds close, which they do around an almost vertical chink, small remaining gaps are filled anteriorly by the tubercle of the epiglottis and posteriorly by the mass of the arytenoids.

Below this level, the false and the true vocal folds represent further sphincters. The division into an upper and a lower pair is not obligatory throughout the animal kingdom, as often they appear in the form of a single girdle. In man the two tiers have different sphincteric qualities and serve different purposes.

The ventricular band sphincter girdle is shelflike with a down-turned free border. The pair contact each other by muscular action with approximation and backward tilting of the arytenoids.

The vocal cord sphincter is a musculomembranous shelf, its general contour is flat above with an undercut inferior surface. When the pair are approximated a dome is formed, the concavity of which faces downward.

The Thyroarytenoid

So far the skeletal-membranous wall structures of the larynx have been discussed together with the muscular activity resulting in alteration of the profiles of these walls. Instead of going into the anatomy and functions of the laryngeal muscles in detail, it is probably more advisable, as physiology of the voice is emphasized, to single out the thyroarytenoid, which forms the bulk under the vocal cord. Modulation of sounds produced between the vocal cords is intimately connected with the pattern of the fibers of this muscle. These fibers are divided into distinct groups; but the manner in which this is accomplished is controversial. Some assert that there are

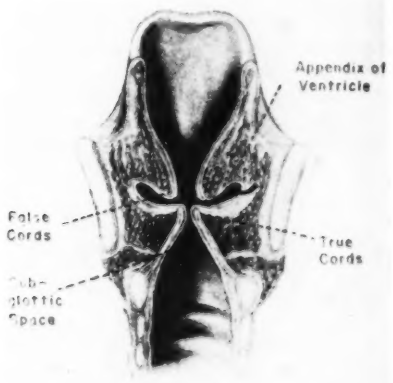

Fig. 1 — Coronal section of the human larynx, exhibiting two tiers of valvular sphincters, functioning in opposite direction. (Pressman, 1954)

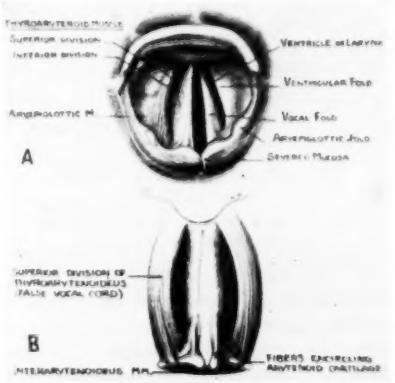

Fig. 2 — *A*, The division of the thyroarytenoid muscle into superior and inferior portions to form the false and the true vocal cords, respectively. The mucosa is intact on the right. *B*, The passage of fibers of the superior division of the thyroarytenoid muscles around the arytenoids to join the interarytenoid muscles in the formation of the "arytenoid sling." (Pressman, 1941)

parallel fibers between both ends, distributed as to their attachment around the vocal process. According to another concept, one group of fibers arises posteriorly around the muscular process of the arytenoid cartilage and, passing forward, gives off bundles which successively, curving inward, attach to the vocal ligament. A second group would arise anteriorly and run backward, with fibers curving inward and again attaching to the vocal ligament. A kind of cross pattern is produced, as these groups run more or less obliquely upward and downward, respectively. Between fetal life and old age this arrangement undergoes changes which may become significant.

There are more concepts regarding the course of the thyroarytenoid fibers. It can be safely said that their arrangement is extremely complex. One would expect this, considering the infinite number of contour changes occurring during the performance of vocal functions.

The action of the intrinsic muscles is closely integrated among themselves, and the combinations are limitless in their effect.

Comparative Anatomy

As happens so many times, comparative anatomy comes to our aid to help us understand where we stand in evolutionary progress.

One of the characteristics of animal voice is its inspiratory production. Another important feature is represented by the hiatus intervocalis (Némai) based on the fact that the arytenoids show a concave medial aspect. At approximation, the two sides form a channel. Although constantly diminishing in diameter in higher forms, this opening is present until the top of the phylogenetic series is reached. It stands for patency of the intercartilaginous glottis and represents a safety valve that remains open during phonation, at the expense of sustained sounds and finer modulation. This section of phylogenetic history dealing with the vocal cord and the intervocal hiatus — and other features can equally serve as examples — demonstrates how laryngeal parts change their structure and function to produce the endless variations under which the vocal organ appears in the different species. They may, as in some primates, show an additional sphincter below the vocal cords, formed by the medial bulge of the thyroarytenoids, which meet in the midline.

The edges of the vocal cords may be drawn out into razor-sharp lips, pointing upward. On the other hand, vocal cords can be found with the upper and the lower profile almost identical. Several arrangements are known which facilitate the production of inspiratory sounds.

Evolution is working along two principles: differentiation and simplification. As to differentiation, every conceivable variation was tried before the human form was reached. The next phase was far-reaching simplification; this means that the parts tend toward reduction in number, but the fewer parts become greatly specialized in their function.

Structurally, the human vocal cord is the first in phylogeny which appears in smoothly closed straight lines between the anterior and the posterior extremity. The intervocal hiatus is still present, but merely in the form of a shallow groove at the inferior surface. Inspiratory sounds have been eliminated, except as clicks in some African languages, and remain only as infantile or pathological phenomena. Among other factors, the air-sac mechanism has disappeared. Just below the human level, it seems, some extremes were tried out. In the larynx of the howling monkey, everything in modulation was sacrificed to give way to the production of sheer volume; the larynx of the chimpanzee is a bewildering array of a number of mechanisms which had to disappear before the smooth modulation of the human voice became possible.

Nervous Control

At this point we might say that the conductor of this richly instrumented orchestra enters the scene: the nervous control.

The nervous apparatus, coordinating the phonation, integrates afferent and efferent impulses, as in other sections of motoric phenomena, at three different levels. The first is located in the medulla oblongata. One step higher, integration

occurs in the mesencephalon, the basal ganglia, and the cerebellum. The third and highest level is the cortex, with the most completely evolved integration apparatus.

An animal still can phonate with all parts of the central nervous system above the medulla oblongata removed. In the latter one finds the nuclei of the motor nerves of the larynx and of other participating muscles; they are obviously under the effect of reflex-irritative impulses arriving on afferent pathways. Voluntary action of the vocal apparatus is rooted in the cerebral cortex in which circumscript areas have a correlation to the laryngeal muscles. In analogy to other musculature, the extrapyramidal system cares for the more delicate coordination of the muscles participating in phonation. This system is formed by the basal ganglia (corpus striatum), the motor nuclei of the midbrain (nucleus reticularis), and the cerebellum.

The nervous control of the muscles of the larynx has been the source of endless disputes. A great deal of confusion was caused by theorizing rather than taking recourse to direct laboratory observation. Other difficulties arose from the fact that results of animal experimentation cannot be applied without restriction to human conditions.

"Vocal Theories"

The "vocal theories" — explanations of the origin of the laryngeal sounds — can be divided into two main groups.

The classic musculo-elastic or "aerodynamic" theory explains the vocal production by considering the vocal cords as a supported vibrating system. A certain amount of respiratory volume, under a certain pressure, moves the elastic vocal cords, which are adjusted by the central nervous system. The vocal cords are fastened into a cartilage-muscle frame, in the manner of cushioned pipes. The larynx forms the initiating part of a resonating system reacting to the source of the sound. The air under the glottis undergoes pressure changes at the beginning and the end of each vibration, corresponding to the closing and opening of the vocal cords; they are not merely pushed apart but are again approximated by suction and by their own elasticity.

In opposition to this theory, the neurochronaxic and cerebral "neurophysiologic" theory of the vibration of the vocal cords was developed by Husson. According to his concept, vibrations result from influxes sent along the recurrent nerve. Phonation is regulated entirely at the cerebral level and not by the respiration. For the speaking voice the initial stimulus comes from the diencephalon or can even be of bulbar origin. In speaking there is no intentional pitch of tone, there is no integration with auditory centers; it is unnecessary, as in normal conversation pitch does not play an important part. On the other hand, in singing, as soon as the interest is centered on a fixed pitch, the diencephalic stimulus is suppressed and cortical centers take over. The three integrating levels show now the following pattern: highest perfection is reached through cortical control, a more mechanical one through the diencephalon, the least expressive through bulbar stimuli.

To summarize the two theories: According to the "classic" tonic theory, the pressure of the column of air from the lungs and trachea initiates a rhythmic opening and closing of the glottis; thus vibrations of the vocal folds are produced primarily by the air stream. According to the clonic theory of Husson, the vibration of the vocal cords is not produced by the air current but by a rhythmic contraction of transverse fibers of the thyroarytenoideus muscle under the stimulus of nervous impulses in the central nervous system; the frequency of the impulses determines the frequency of the sound waves being emitted.

The overwhelming majority of experimental and clinical findings was marshalled along a line in favor of the classic and against the clonic theory. But after the publication of the latter, refreshed vigor in experimental and clinical investigation testified to the fact that the related questions are still far from being definitively clarified.

Support for the clonic theory came from a direction of particular importance

from the viewpoint of rehabilitation. When applied to management and treatment in voice pathology, the cerebral origin of tones comes closer to a mental concept as the emotional influence on tone and the tonal expression of emotional disturbances becomes evident (Moses).

Speech

The larynx is the source of the sound, but it is not to be considered as the organ of speech. It produces the raw material in the form of sound which is modified into voice by resonating chambers located above and below the larynx. To form speech, collaboration of the pharynx, tongue, palate, lips, and nasal cavity is necessary. Esophageal speech, in laryngectomized patients, works even without the primary sound production in the larynx.

Reference to tones of varying pitch as "head tones," "chest tones," "middle mechanism," or "falsetto," is made as a purely artificial division (Pressman), as is division into bass, baritone, tenor, contralto, and soprano, from the standpoint of the physiologist. Others consider vocal registers an undeniable phenomenon of every normal voice. A reconciliation of the two concepts may be possible along the "one-register theory," considered as the aim of vocal training. It means equalization of registers, elimination of breaks at the transitions. In a well-trained voice the "registers" are always gradually mixed.

The intensity of the tone depends on the amplitude of the vocal cord vibrations. The amplitude again depends partly on frequency, as low tones have a wider amplitude than high tones. The most important determinator in this respect remains the subglottic air pressure.

Production of vowels is the result of strictly periodic vibration. While this is the case in singing, vowels in ordinary speech will at least approximate this periodicity. "Voiced" consonants are a kind of transition between vowels and unvoiced consonants. Consonants are produced at different, characteristic articulation points in the resonating chambers.

Future of Laryngeal Development

It may be advisable to glance in the direction of the future of laryngeal development and ask if the human vocal cord and its productions were not overshot in some other species?

While the phylogenetic scale progressed from the lung fish, with its few circular muscle fibers as a sphincter, to the larynx as an organ capable of a wide range of tones, many combinations were, "tried out." Monkeys with long vocal cords and delicate cartilages produce shrill, unpleasant tones as a consequence of their sharp vocal lips. In ruminants the thyroarytenoid folds are rounded, and pitch and volume are poorly controlled. It is said that the most pleasant human tones are produced with vocal cords tending, at their edges, toward a rounded profile. The vocal cord of the gibbon (Hylobates) is divided by a longitudinal furrow into two halves, the upper half representing the true vocal cord, the lower an additional one. This division runs the entire length of the cord, with the intervocal hiatus almost completely reduced. Double sounds are possible and, in fact, were observed. It is hard to say whether this duplication in structure and performance is purely vestigial, as it is seen in some lower forms too, or whether it is a precursor pointing to wider vocal potentialities in the future.

Study of laryngeal anatomy is vigorously followed at present along the main lines of general structure, arrangement of the fiber bundles of the musculature, and especially in the thyroarytenoideus muscle, all-important in voice production. Another line is represented by comparative studies. Careful and detailed investigation can refute the old conception according to which it is only the poorly developed mental sphere which stands in the way of using the allegedly perfectly developed monkey larynges in a more humanlike way. Better insight, first of all in anatomy, has shown, however, that remarkable vocal performances are present but must differ from the human production, as the larynges of the different species are composed of elements widely differing from the human structures and their arrangements.

Lively discussion regarding the tonic and the clonic theory shows that the inseparable disciplines of anatomy and physiology of the larynx are the objects of common investigation. A similar endeavor can never end; but one can hope that areas which seem confused today will be cleared one by one to build a more comprehensive concept. There is no safer way than to return to the rock-bottom base represented by anatomy.

Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

Announcing . . . **A NEW EXPANSION PROGRAM OF EDUCATIONAL ACTIVITIES IN PROSTHETICS AND ORTHOTICS**

New York University has inaugurated a four-year curriculum leading to the degree of Bachelor of Science in the field of prosthetics and orthotics. The program will begin in September 1960. The course of instruction, which has been developed in conjunction with the University's Post-Graduate Medical School and College of Engineering, is being offered by the School of Education. The curriculum, which is designed so that the graduate will be provided with a broad general educational background as well as being qualified in all aspects of the limb and brace fitting field, consists of 130 academic credits and contains instruction in English and speech, mathematics, physical and biological sciences, basic engineering, psychology, sociology and social studies, and shop methods. In addition, specialized practical courses in the fields of upper and lower extremity prosthetics and orthotics, as well as orthotics for the trunk are included. These courses will be supplemented by a clinical training program developed in cooperation with the American Prosthetic and Orthotic Association and a number of certified limb and brace making facilities throughout the country. **Those interested in formally applying for admittance to the curriculum should contact the Admissions Office, School of Education, New York University, Room 12, Press Building, Washington Square, New York 3, New York.**

NYU Post-Graduate Medical School will offer a series of two-week summer courses in prosthetics in cooperation with the International Society for the Welfare of Cripples just prior to the Eighth World Congress. These courses will constitute the Third International Prosthetics Course sponsored by the Committee on Prosthesis, Braces and Technical Aids of the ISWC. Separate two-week courses for (1) physicians and surgeons; (2) therapists; and (3) prosthetists, will be offered each meeting from **August 15 through 26, 1960.**

NO. 741-1 (for PHYSICIANS and SURGEONS) — Covers principles of biomechanics, fabrication, fitting, alignment, suspension, harnessing, prescription and evaluation of lower and upper extremity prostheses. Surgical technics, prosthetic components, performance analysis and training are also included.

NO. 742-1 (for PHYSICAL and OCCUPATIONAL THERAPISTS) — Covers pre-operative and post-operative care, prosthetic components, biomechanics, fitting and alignment principles, prosthetic evaluation and training of both the lower and upper extremity amputee. Special attention is given to the analysis of amputee performance, methods of prosthetic training, and correction of problems.

NO. 743-1 (for PROSTHETISTS) — Major topics are biomechanics, fabrication procedures, including use of plastics, fitting principles, dynamic alignment, the adjustable leg and duplication jig and suspension methods. Two complete prostheses will be fabricated and fitted by each student. Additional subjects include anatomy, surgery, pre-operative and post-operative care, and prescription principles.

Applications and further information concerning these courses may be obtained by writing: Sidney Fishman, Ph.D., Director, Prosthetics Education, New York University Post-Graduate Medical School, 342 East 26 Street, New York 10, N. Y.

Muscle Relaxants in Cerebral Palsy; A Comparative Study. II: Chlorophenylmethylthiazanone Sulfone (Trancopal)

Harold M. Sterling, M.D.
Brighton, Mass.

● Four children having spasticity, athetosis, or both, affecting the control of the upper extremities were given Trancopal in a specified dose for six weeks. Comparison of each child's performance on a specially selected test designed to show possible improvement in rate of manual manipulation during the control period and the period of medication or placebo administration showed no significant change. Comparison of their performance with children who received a placebo failed to reveal any significant difference which could be attributed to a drug effect.

The effect of various drugs on the performance of patients with spasticity and athetosis has been the subject of a number of recent communications.[1-5] Unfortunately a number of such drugs after initial encouraging reports have been disappointing in their lack of effect on the underlying neuromuscular problem or in their toxicity and side reactions.[6-8] For this reason an attempt has been made in this study to minimize subjective error by recording skill of repetitive manipulation during a measured time.[9, 10]

Method and Material

Five boys and two girls, age two to four years, attending the Minneapolis Curative Workshop Nursery School were studied daily during 1958. All showed spasticity, athetosis, or a combination of both which impaired the use of both upper extremities. A task was selected for each child which would be somewhat difficult because of his disability but in which learning would not be likely to influence performance (table 1). Observations were made twice weekly for periods of time ranging from 2 to 3 minutes throughout the time of this study. The children did not perform the activity selected at other times.

Small tablets of the drug chlorophenylmethylthiazanone sulfone (Trancopal*) containing 100 mg. or identical appearing placebo tablets containing no active ingredient were supplied to be taken at home three times a day for 6 weeks. Four children received the drug. Three received the placebo.

Medical Director, Joseph P. Kennedy, Jr. Memorial Hospital, Brighton, Mass.; formerly, Instructor, Department of Physical Medicine and Rehabilitation, and Department of Pediatrics, University of Minnesota Medical School; Medical Consultant, Minneapolis Curative Workshop Nursery School, Minneapolis.

*Supplied by Winthrop Laboratories.

Table 1: Task Selected

Patient	Diagnosis	Test	Time Allowed, Minutes
L. M.	Spasticity	Marble chute	2
J. Z.	Spasticity	Marble chute	2
B. B.	Spasticity	Remove pegs Ball transfer	2 2
D. S.	Spasticity Athetosis	Spools on tree	2
P. M.	Spasticity	Place small pegs	2
J. E.	Spasticity	Place large pegs	3
R. B.	Athetosis	Bead stringing	3

Table 2: Average and Ranges of Performance under Varying Conditions

	L. M. (Marble Chute)		J. Z. (Marble Chute)		B. B. (Balls)		B. B. (Pegboard)		D. S. (Spools)	
	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range
Control period	6.4	4-10	5.7	5-8	2	1-4	4.4	0-6	8.8	5-12
Medication period	5.7	5-7	6.0	4-7	2.8	0-6	3.6	0-5	4.3	3-6

Results

Table 2 shows the performance of each child during the placebo or medication trial as compared to the control period. Performance is recorded both as the mean number of manipulations for each test period as well as the range from poorest to best total performance in one observation period. Statistical analysis fails to reveal any significant difference between the performances of the children under varying conditions, although one individual (D.S.) appears to have done more poorly while receiving the drug.

Summary and Conclusions

Four children between the ages of 2 and 4 years having spasticity, athetosis, or both, affecting the control of the upper extremities, were given 100 mg. of chlorophenylmethylthiazanone sulfone (Trancopal) three times daily for 6 weeks. Comparison of each child's performance on a specially selected test designed to show possible improvement in rate of manual manipulation during the control period and the period of medication or placebo administration showed no significant change. Comparison of their performance with the three children who received a placebo which was identical to the drug in appearance failed to reveal any significant difference which could be attributed to a drug effect.

The selection of various activities representing approximately an equal level of difficulty for each child, even though the activities themselves are of widely differing character, allows an objective recording of performance which can be handled statistically, minimizing subjective error and other extraneous factors which might otherwise influence the results.

Table 3: Average and Ranges of Performance under Varying Conditions

	P. M. (Pegboard)		S. E. (Large Pegs)		R. B. (String Beads)	
	Average	Range	Average	Range	Average	Range
Control period	11.5	10-13	4	3-5	2	-2-
Placebo period	13.25	8-17	4	3-5	5.7	4-7

One child receiving the placebo did much better than he had done during the control period. This is similar to our findings in a similar group of children being studied for the effect of meprobamate and matched placebo.[10] Contrary to the opinion of many workers, these observations indicate the need for placebo control of drug studies in very young individuals even though the children themselves may not be affected by suggestion or desire for the medication to have an effect (table 3).[11]

There were no observable untoward effects noted in any of the seven subjects.

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Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

we meet . . .

in washington, d. c. . . .

in 1960 . . .

Pre- and Post-Partum Exercises: Technics, Indications, Benefits

George C. Twombly, Jr., M.D.
Denver

● The prescribing of both pre- and post-partum exercises is increasing. In a significant number of hospitals the responsibility for the administration and supervision of the exercise program is being assumed by the department of physical medicine and rehabilitation. This trend would seem to be a logical one since various forms of exercise comprise an integral and most important part of the activity of any department of physical medicine and rehabilitation. Success of the program depends upon cooperation between obstetrical and physical medicine departments. Exercise technics; methods of instruction; acceptance of program by patient and doctor; physical and psychological benefits; anatomical considerations; limitations and precautions; relation to so-called Natural Childbirth Methods; role of the physical therapist, physiatrist and obstetrician and methods and problems of evaluation are discussed. This report is partially based upon the results of a four-year study (1955-1958) conducted in a private hospital with 5,047 maternity patients.

During the past decade the prescribing of both prenatal and post-partum exercises has increased. The impetus for this popularity may be related either directly or indirectly to the influence of the widespread teaching of natural childbirth methods and principles by the late Dr. Grantly Dick Read.[1]

Actually the use of such exercises is not a twentieth century medical achievement since obstetricians long ago recognized many of the indications and benefits of such procedures. However, within recent years more scientific and systematic programs have been developed as the physical and psychological benefits of such exercises have become more apparent.

Most obstetricians are certainly capable of prescribing and supervising either prenatal or post-partum exercise regimes, but, as will be mentioned later, many busy physicians find it too inconvenient and time-consuming and prefer to refer their patients to established exercise classes. In a significant number of hospitals where such programs are in operation, the responsibility for the administration and supervision of these classes is being assumed by the department of physical medicine and rehabilitation. This trend would seem to be logical since various forms of exercise comprise an integral and most important part of the activity of any such department. The success of the program depends to a great extent upon the mutual understanding and cooperative efforts of the physiatrist, physical therapist, and staff physicians.

Since considerable controversy and misunderstanding still exists regarding Dr. Read's well-known natural childbirth theory, mention will be made of it and its relationship to the exercise programs under discussion.

Some 50 years ago, Dr. Read, an English obstetrician, began recording certain observations of the physical and emotional aspects of pregnancy. Later, from these observations, the principles and practice of natural childbirth evolved and his book *Childbirth without Fear* was published.

Dr. Read was perturbed by the fact that childbirth was apparently the only natural physiological function associated with pain. He searched for an explanation as to why some women seemed to experience minimal obvious pain and fear during labor and delivery, while others suffered so much. As a result of his analyses, he proposed the well-known fear-tension-pain syndrome as the basis for excessive discomfort. By substituting reassurance and knowledge for fear, and relaxation for tension, pain is lessened and the vicious cycle is broken. The effect of fear, created by anxiety and labor pains, upon the thalamus, which in turn influences the activity of the sympathetic nervous system, is a recognized physiological phenomenon. Circulatory or inhibitory muscle fibers of the lower uterine segment are those stimulated by the sympathetic nervous system.[2] Their contractions create a state of rigidity in the lower segment and outlet of the uterus.

Read at the Thirty-seventh Annual Session of the American Congress of Physical Medicine and Rehabilitation, Minneapolis, September 2, 1959.

Assistant Professor of Physical Medicine and Rehabilitation, Department of Physical Medicine and Rehabilitation, University of Colorado School of Medicine; Director, Department of Physical Medicine and Rehabilitation, St. Joseph's Hospital.

This introduces resistance to the expulsive efforts of the longitudinal muscle fibers of this organ.

Thus, Dr. Read stressed the importance of reducing both fear and tension in the woman as a means of eliminating much of the pain of labor and the delivery process. Two approaches which he advocated were adequate counseling and instructional sessions between the patient and her obstetrician during pregnancy, and teaching of certain voluntary relaxation and breathing technics. These latter two procedures should be included in the curriculum of every prenatal exercise class.

Medical reaction to the Read method is mixed. Probably the majority of physicians consider the phrase "childbirth without fear" as being more realistic than the oft-used expression "painless childbirth." Many obstetricians appear willing to agree in part with some of the practices and principles which Dr. Read advocated, but resist complete acceptance of all of his theories.

Prenatal Exercises

The purpose of prenatal exercises is to reduce some of the discomfort during pregnancy, and to better prepare the woman physically and psychologically for the actual delivery process. Too many women and physicians still consider prenatal exercises and natural childbirth as being synonymous. The natural childbirth method as proposed by Dr. Read is not necessarily used for all women who engage in prenatal exercise classes. If the natural childbirth method is to be employed, prenatal exercises are a necessary requisite. But properly performed prenatal exercises will be beneficial in any type of vaginal delivery which the woman will have regardless of the type or amount of anesthesia or analgesia used. Thus, quite often the success or failure of a prenatal exercise program is dependent upon a clarification of the purposes and objectives of the program, with assurance, when indicated, that prenatal exercises can be taught without mention of natural childbirth. If the patient's physician himself gives the exercise instructions, then he can either encourage or discourage the Read method. If a physical therapist has been delegated the responsibility of teaching the exercise classes, she must not endorse the natural method for the patients unless the referring physicians have approved of such. If prenatal exercise classes are to succeed, the therapist must remember to teach only exercises and related topics and leave the discussion of other aspects of pregnancy and delivery for the patient's physician.

Prenatal exercises are ideally started after the first trimester of pregnancy. Since a certain percentage of women experience some difficulty with threatened abortion during the first three or four months of pregnancy, it is safer to wait until at least the fourth month before starting the exercise regime. The usual recommended procedure is to prescribe no prenatal exercises prior to the fourth month, nor after the eighth month of pregnancy. This does not mean that a woman with a normal pregnancy cannot continue performing most of the exercises after the eighth month, but she will find it much easier to perform certain of the exercises if they are started during the second trimester.

No patient should attend prenatal exercise classes without first getting approval from her personal physician. If the referring physician enthusiastically endorses the classes, his patients will tend to acquire the same eagerness and acceptance. Many physicians find that it is too inconvenient and time-consuming to personally conduct such classes and thus they are agreeable to referring their patients to a well-supervised and well-administered class if one is available. Many such classes are now conducted in hospitals or large clinics under the direction of the department of physical medicine with the approval of the obstetrical service. Because of the nature of these prenatal classes, a female physical therapist who is well trained in the principles of such exercises is the best individual to conduct such a program. She should work under the direction of a qualified physiatrist if the program is being conducted in a hospital, or under the supervision of the physician in charge

if these are given in a private office or clinic. Time must be allowed in these classes for the women to ask questions since most of the participants eagerly seek more knowledge regarding various aspects of their pregnancy and the purposes and benefits of the prescribed exercises.

No physiatrist should consider establishing either a prenatal or post-partum program in a hospital without consulting the obstetrical service for its support and advice. The physiatrist who fails to gain the support of the obstetricians and to solicit their suggestions deserves the inevitable problems which he will certainly encounter. A mutual understanding between the obstetrical and physical medicine departments regarding the conduction of the prenatal and post-partum exercise programs can lead to a highly successful venture.

Physicians and patients alike are certainly aware of the fact that a pregnancy can proceed to a successful termination without the benefit of prenatal exercises. However, if the addition of certain exercise procedures would contribute to the physical comfort and mental serenity of most pregnant women, is one not justified in considering the prescribing of such? The primiparous patient in particular commonly proceeds through pregnancy with certain misconceptions and anxieties. Some of these are effectively allayed by her physician during her periodic visits to his office. But quite often the busy physician has only time to answer certain pertinent questions related to various physical changes occurring with the natural progression of pregnancy. Such doctors are seldom reluctant to leave the discussion of various factors relating to posture, rest, breathing technics and therapeutic exercises to the trained physical therapist who can include these subjects in scheduled classes. Most maternity patients gain considerable confidence and reassurance not only from their periodic visitations to their physician, but also from their participation in a prenatal exercise program. They soon become aware that the technics and activities which they are mastering will prepare them for a more comfortable pregnancy and a less complicated delivery.

During the past decade, the number and type of prenatal exercises taught have become reasonably well standardized. Minor variations may occur, but most prenatal exercise programs include in the curriculum proper rest positions, technics of progressive relaxation,[3] controlled breathing, posture correction, perineal (pelvic floor) exercises, protection of the low back from strain, abdominal tone exercises, stretching of the low back and gluteus and leg adductor muscles, relief of leg (circulatory) pains, and exercises to increase the strength, tone, and elasticity of pelvic floor muscles in preparation for labor and better post-partum "comeback."

Proper rest positions are especially beneficial to the woman during her second and third trimesters. Comfortable rest positions and methods for relieving unnecessary tensions to promote more complete relaxation should be learned. Certain of these relaxation principles apply also during the first stage of labor.

Breathing technics should be taught to the pregnant woman well in advance of the expected date of delivery.[4] Many obstetricians state that a woman's most essential work during labor and delivery is accomplished by her controlled breathing. It is quite important then to adequately explain to a woman the definition and significance of such terms as "panting," "bearing down," and "abdominal breathing." Too often the physician suddenly commands the patient during delivery to establish a certain type of breathing pattern without a realization that she may have no concept whatsoever of the terminology he is using. Even during the first stage of labor, properly performed abdominal breathing done during the presence of labor pains may partially relieve the discomfort. The woman who learns and practices these breathing technics early during her pregnancy, inevitably gains increased confidence and reassurance as term approaches.

Numerous physicians and patients are of the opinion that the most significant contribution of prenatal exercises is the

reduction in the incidence of backache. It is well known that certain women experience more back pain than others during pregnancy. The scope of this paper will not permit a discussion of the proposed etiology of backache in the pregnant woman. Instruction should be directed toward providing exercises to reduce unnecessary strain and assist in optimal maintenance of correct postural alignment.[4] The "pelvic tilt" is undoubtedly the one most important exercise in this regard. Advice regarding protection of the low back from strain when lifting is also valuable information for the expectant woman.

Exercises and positions for providing gradual stretching of the low back, gluteus maximus, and hip adductor muscles should be stressed. Since in the usual position for delivery it is inevitable that these previously mentioned muscle groups will be subjected to increased stretching, preliminary exaggerated hip and knee flexion with the thighs widely abducted will prepare the woman for a more comfortable experience on the delivery table.

Prenatal exercise classes should be limited to a maximum of 10 or 12 women per class. Group therapy is recommended, but time must be allotted for individual instruction. The exercise classes should be conducted in a private room provided with floor mats since most of the exercises require the woman to assume either a sitting or lying position. Suitable clothing for participating in the exercise program should be worn.

Post-Partum Exercises

In uncomplicated deliveries, post-partum exercises can be started the day following delivery. Since the modern practice is to discharge a woman from the hospital on her fourth or fifth post-partum day, the exercise sessions are usually given once daily on the first, second, and third post-partum days.

On the first day, the regime is usually performed with the woman at bedrest and consists of abdominal breathing, pelvic tilt exercises, and mild perineal contractor exercises for tightening of the pelvic floor musculature. This latter exercise is performed by having the supine patient cross her ankles, squeeze the buttocks together, contract the lower abdominal muscles, and adduct the thighs. On the second and third days, these exercises are continued, but the posture and pelvic tilt exercises are practiced in the standing position. In addition, mild abdominal exercises for increased tone are started. For upper abdominal strengthening (rectus abdominus), the patient, in the supine position with knees flexed and arms across the chest, tucks in her chin and lifts the shoulders off the bed or floor. The internal and external oblique muscles are exercised by having the patient raise one extended leg at a time from the supine position reaching at the same time for the toes with the opposite hand. This is repeated alternating sides. In addition, suggestions are given for protection of the low back when doing housework or lifting.

Some physicians recommend one additional position known as the "knee-chest" position. Those who endorse this during the early post-partum period state that it promotes more rapid and complete restoration of the uterus to its normal anteverted position. Other physicians doubt that the technic has much effect in accomplishing this. Many, however, have discontinued prescribing the "knee-chest" position for another and probably more significant reason. There have been reports of fatal cases of air embolism apparently resulting from the performance of the knee-chest maneuver during the early post-partum period. In view of these reported cases, an increasing number of obstetricians are requesting that their patients refrain from assuming this position until the end of the sixth post-partum week.

Results of a study involving 5,047 post-partum patients during a four-year period (1955-58) revealed that the vast majority of these women enthusiastically accepted the exercise program. Because of the benefit of previous experience, multiparous patients often appeared more appreciative and cognizant of the real value of these exercises than did women who had just completed their first pregnancy. The exercise sessions were conducted by a female physical

therapist for patients whose obstetricians had specifically requested such exercises. A large percentage of the obstetricians and general practitioners on the staff of the private hospital* where this program is in operation, approved of and utilized the services of the physical therapist for supervising the exercise classes.

Most of the patients requested written instructions with picture diagrams of the exercises for future reference after discharge from the hospital. In spite of the fact that many women had previously had post-partum exercise instructions with other pregnancies, they still requested an opportunity to again have supervised instruction. Even though group post-partum instructional sessions have obvious advantages, especially from the standpoint of the instructor, they are usually less satisfactory than individualized sessions. Unless the technics and purposes of each exercise are carefully explained and demonstrated, the woman will be inclined to discontinue the exercises after leaving the hospital. Ideally, the post-partum exercises should be done once or twice daily for the first six weeks following delivery. In Caesarian sections, there is a necessary delay and certain modifications in the usual post-partum exercise regime.

Stress Incontinence

The relationship of proper muscle exercises to the prevention or correction of urinary stress incontinence in the female has been emphasized by Ullery and others.[5] The preventive treatment of acquired urinary stress incontinence should be instituted early in pregnancy, and carried on throughout the prenatal, delivery, and post-partum periods for both primiparous and multiparous patients. Kegal and Bushnell believe that proper voluntary and resistive muscle exercises should be instituted very early in pregnancy to strengthen the pelvic musculature and fascias, and thus enable the patient to better undergo the demands of parturition, and prevent strain on the pelvic floor with the general relaxation of the pelvic fascia and muscles which occur in pregnancy. She should be taught how to voluntarily and effectively contract certain muscles of which she may not have been consciously aware.

In this respect, Ullery stresses the importance of the pubococcygeus muscle. The patient must learn and practice voluntary control of this muscle through association with other muscular functions already under conscious control — such as preventing defecation or stopping and starting urination. She must develop the ability to retract the anus firmly until the sensation of drawing it up into the rectum is felt. By frequent repetitions, the strength of the contractions will increase if the exercise is being properly performed, and the patient will progressively gain better conscious control of the pubococcygeus muscle. Fifteen to twenty-five contractions, three times a day, are recommended. Much of the success of this particular exercise is dependent upon the personal supervision and rechecks of the patient's proficiency by the physician himself.

Two effective methods are used to determine whether or not the patient has learned effective conscious control of the pubococcygeus muscle. One is by vaginal insertion of the gloved finger to detect manually whether or not the woman can produce voluntary muscular contractions. The second method employs the Kegal perineometer (an instrument designed to indicate visually the strength and amplitude of contractions of the pubococcygeus muscle). This instrument is also of value when used to offer resistance for strengthening muscular contractions.

The patient is instructed to exercise the perineal muscles on a regular daily schedule, and she is then rechecked periodically by her physician at the time of her prenatal visits. The woman should also be encouraged to continue the perineal exercises during the post-partum period, beginning while she is still in the hospital. This system of exercises has definite possibilities in the prevention of stress incontinence, but reduction of unnecessary perineal trauma during the delivery process is also of vital prophylactic significance.

If stress incontinence already exists, Kegal recommends a sustained trial of

*St. Joseph's Hospital, Denver, Colorado.

at least three months of exercise employing the perineometer for 20 minutes three times a day. In many cases, this regime will result in complete or partial relief of symptoms in a certain percentage of women, and, if so, it should be continued. If no significant results are noted in the improvement of the stress incontinence, then operative treatment should be considered.

Pubococcygeal exercises as mentioned previously should always be included in both prenatal and post-partum exercise programs.

Conclusion

The purpose of this paper was to re-emphasize the technics and benefits of both prenatal and post-partum exercises, and to discuss briefly some of the aspects related to the conduction and organization of such exercise programs. Mention was made of the natural childbirth method proposed by Dr. G. D. Read, and its relationship to prenatal exercises.

Obvious difficulties are encountered in the objective or statistical evaluation of the true values of these exercise routines. Problems prevail in seeking factual evidence to prove that the woman who performs prenatal posture exercises will have less backache than one who did not, or that the woman who performs perineal exercises will deliver with less dystocia and soft tissue tears. The scientific evaluation of these procedures is complicated by individual patient differences, and intangible human variables of both a physical and psychological nature.

The justification for the prescribing of prenatal and post-partum exercises by the intelligent physician must be based upon knowledge of accepted anatomic and physiologic facts. Relating these data to an understanding of the beneficial physical and psychologic alterations attainable, the merits of such a program should receive increasing medical recognition and acceptance.

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Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

Outside show is a poor substitute for inner worth.

— AESOP

To perceive things in the germ is intelligence.

— LAO-TSZE

editorial

A Progress Report To Medical Scientists

Recently we received the following letter from Lester R. Dragstedt, M.D., President of the National Society for Medical Research, 920 South Michigan Boulevard, Chicago. It appeared to us that the letter was so pertinent and timely with regard to the training in proper care of animals used for laboratory teaching and laboratory research, that it is herein reproduced. The National Society for Medical Research was organized by Anton J. Carlson and other leaders in the biological sciences to provide a means of coordinating the efforts of many scientific societies for public education regarding the use of animals in medical research and regarding the proper care of laboratory animals. The humane philosophy of the National Society for Medical Research is obvious. The useful services which it performs deserve the support of the entire medical profession.

NATIONAL SOCIETY FOR MEDICAL RESEARCH

A Progress Report to Medical Scientists

"Science teaching in the elementary and secondary schools of America is undergoing a revolution. Students are conducting scientific explorations that are original at least for them. Not many years ago in most schools, science was taught almost like history — as a vast collection of information to be absorbed and parroted back at examination time.

"Thanks largely to science club projects, more and more youngsters are becoming acquainted with science as adventurous exploration. And the imposing heritage of scientific information is becoming more palatable as students come to regard it as a helpful source material for the solution of the real and exciting challenges before them.

"Almost everybody seems to be pleased with the idea of having students learn about science by personal investigation. This, it seems agreed, does more to make students understand what science is all about than the recollection of any number of particular facts and figures. More young people can be expected to become excited about careers in science, and those who go into other fields, where bits and pieces of scientific data would be of little value, have at least a better understanding of the nature and value of scientific research.

"Student research does find opposition in one quarter, however. Some animal welfare workers oppose the study of living creatures by students in the life sciences. Obviously there can be no argument that animals studied by students should be treated humanely. But must biology be the forbidden science?

"The essence of the debate over the student use of animals is found between the lines rather than in the directly expressed arguments. After all, if there is no argument about the need for humane care, what is there to argue about?

"People concerned with the development of scientific talent resent having animal studies made to seem intrinsically evil. They fear regulations which like building codes, could be the basis for dishonest harassment.

"On the other side, the opponents of animal studies would sacrifice biological science if necessary to prevent mishaps in animal care. This is like abolishing automobiles to stop traffic accidents.

"It is important for science and important for the humane concerns of mankind to resolve this conflict intelligently. It would be a tragedy if animal studies by pre-college students were to become taboo. There must be earnest effort to improve animal care rather than simply defending the status quo.

"One of the most important responsibilities of the National Society for Medical Research in coming months will be to try to bring about a wise resolution of the dispute over the use of animals in the teaching of biology to pre-college students.

"I hope not only that you will support this work but that you will also give us the benefits of your thoughts on this problem. Will you send me your suggestions?

Very sincerely yours,
Lester R. Dragstedt
President"
— *Frederic J. Kottke, M.D.*

Circumstances are beyond the control of man;
But his conduct is in his own power.

— DISRAELI

survey of selected literature

This systematic abstracting and indexing of selected journals is made possible by a grant from the American Rehabilitation Foundation, a subsidiary of the Sister Elizabeth Kenny Foundation.

ACTA PHYSIOLOGICA SCANDINAVICA. *Vol. 48 (Supplement 166) 1960.*

◇ **Experimental Evaluation of the Hypothesis of Ligamento-Muscular Protective Reflexes. 3. A study in man using the medial collateral ligament of the knee joint. I. Petersen, and B. Stener. pp. 51-60.**

For a long time it has been assumed that articular ligaments, instead of acting only as purely mechanical obstacles to abnormal movements of a joint, have a most important task in the initiation, via tension receptors, of a reflex contraction of the muscles capable of opposing the abnormal movement. Experiments have been performed in man to test this hypothesis. The medial collateral ligament of the knee joint was chosen for the experiments. The tension in the ligament was increased by forcibly abducting the tibia on the femur. During such stimulation the motor activity in the sartorius, semimembranosus and vastus medialis muscles (i.e. in the muscles capable of opposing an increase in tension in the ligament) was studied by electromyography. In 35 subjects, without known injury or disease in the knee joint, it was not possible to detect any reflex motor effects ascribable to stimulation of receptors in the ligament. This is in close agreement with the results obtained in cats by Andersson and Stener. Taken together, the results of these two investigations provide reasons to doubt the existence of a protective muscular reflex, originating in tension receptors located in ligaments.

Experimental evaluation of the hypothesis of ligamento-muscular protective reflexes. 1. A method for adequate stimulation of tension receptors in the medial collateral ligament of the knee joint in cat, and studies of the innervation of the ligaments. *Stener, B. p. 5.*

Experimental evaluation of the hypothesis of ligamento-muscular protective reflexes. 2. A study in cat, using the medial collateral ligament of the knee joint. *Andersson, S., and Stener, B. p. 27.*

ACTA PHYSIOLOGICA SCANDINAVICA. *Vol. 48 (Part I) 1960.*

◇ **Cholinesterases and Innervation of Skeletal Muscles. G. Haggqvist. pp. 63-70.**

In skeletal muscles there are two types of motor endings. One is characterized as a plaque type and belongs to the coarse phasic nerve fibers. The other is characterized as a grape type and constitutes the termination of fine efferent fibers, which is considered to be the nervous substrate for muscle tonus. In the femoral biceps muscles from cats, Holmstedt found motor endings containing butyrylcholinesterase (BuChE) as well as acetylcholinesterase (AcChE). This investigation is directed toward the possibility of a relationship between the two cholinesterases, the two types of end plates, as well as phasic and tonic nerves.

Tonic muscles in Gynomolgus were used for the examination. For staining, Holmstedt's modification of Koelle's thiocholine method was used. The buccinator muscle is a typical tonic muscle that seldom contracts voluntarily. In five patients in which the entire muscle was examined, not a single motor ending with AcChE was found, whereas motor endings with BuChE were found in large numbers. The anal sphincter nerve consists predominantly of delicate fibers. In a large number of anal sphincter muscles, impregnated with silver, only grape-like motor endings could be observed, and only motor endings with BuChE were found. The external rectus muscle of the eye receives its nerve fibers through the sixth cranial nerve. The fibers of this nerve are predominantly coarse. On silver impregnation of this muscle, only plaque-type motor endings were found. The cholinesterase experiments showed that a large

number of motor endings with AcChE exist in the muscle, whereas none with BuChE have been established. The superior oblique eye muscle gets its innervation from the fourth cranial nerve. This nerve consists of both coarse and fine fibers; both kinds of motor endings are found in the muscle. End plates with AcChE as well as BuChE have been found. Thus, there seems to be good parallelism in the relationship between coarse and fine nerve fibers in the muscle nerves and motor endings of a plaque type and a grape type and the existence of endings with AcChE and BuChE on the other hand.

Venous blood flow recorded with an isothermal flowmeter. *Mellander, S., and Rushmer, R. p. 13.*

Quantitative measurements of sweat gland activity using the ninhydrin method. *Ponten, B. p. 20.*

Carbon dioxide tension and pH of lymph and arterial blood in anesthetized dogs. *Carlsten, A., and Soderholm, B. p. 29.*

Some types of response of single cells in the rabbit lateral geniculate body to stimulation of the retina by light and to electrical stimulation of the optic nerve. *Arden, G., and Liu, Y-P. p. 36.*

CIRCULATION. *Vol. 21, Jan. 1960.*

◇ **Hemodynamic Aspects of Congestive Heart Failure. L. N. Katz; H. Feinberg, and A. B. Shaffer. pp. 95-111.**

This article is essentially a review of basic concepts of congestive heart failure. Recent work, both clinical and experimental, is cited. Characteristics of the failing heart are outlined. The epitome of heart failure is the need for tachycardia to increase minute output, and the need for greater end-diastolic volume in order to increase output and overcome augmented systolic loads. The ultimate phenomena of heart failure appear to reside in the heart muscle itself. Abnormalities in energy utilization and release for the development of myocardial tension appear to be less often involved in failure than is the actual conversion of tension to external work. As the authors point out, our knowledge of congestive heart failure is still elementary.

◇ **The Kidney in Congestive Heart Failure. A. C. Barger. pp. 124-128.**

Early in the pathogenesis of congestive heart failure there is increased tubular reabsorption of sodium. Later, a reduced filtration rate, apparently the result of progressive renal vasoconstriction, aggravates the tendency toward sodium retention. The increase in sympathetic activity in the kidney is initiated by decreased baroreceptor activity in the carotid sinus and aortic arches. This response occurs in other circulatory disturbances than congestive heart failure. Blocking the adrenergic nerves to the kidney produces marked diuresis and salt loss. The baroreceptors (presso-receptors) may also be responsible for increased aldosterone secretion by the adrenal cortex in congestive heart failure. Rational therapy is directed toward increasing baroreceptor activity and hence reflexly results in decreased sympathetic tone in the kidney, diminished aldosterone secretion, and consequent increase in salt and water excretion.

A study of the cardiac stigmata in prolonged human thiamine deficiency. *Rowlands, David T., Jr., and Carl F. Vilter. p. 4.*

Hemodynamic and hypotensive effects of long-term therapy with chlorothiazide. *Conway, James, and Philip Lauwers. p. 21.*

A study of renal function in orthostatic hypotension. *Brodwall, Erling Kruge. p. 38.*

CIRCULATION. *Vol. 21, Feb. 1960.*

◇ **Arteriosclerosis Obliterans: Review of 520 Cases with Special Reference to Pathogenic and Prognostic Factors. John L. Juergens; Nelson W. Barker, and Edgar A. Hines, Jr. pp. 188-195.**

The purpose of this study was threefold — to gain clinical information from a large series of patients; to obtain information regarding factors which influence prognosis in respect to life and the preservation of limbs; to compare results in this group with results in other groups in which direct arterial surgery is being done.

Five hundred twenty non-diabetic patients less than 60 years of age with the clinical diagnosis of arteriosclerosis obliterans of the lower extremities made at the Mayo Clinic in the period 1939 through 1948 were reviewed from the standpoint of pathogenesis, prognosis and clinical course. The ratio of males to females was 11 to 1. The mean concentration of plasma cholesterol in the males was about 50 mg. per cent greater than that of either of two control groups of men without clinical evidence of atherosclerosis. The incidence of smoking in the disease group was higher than in a comparable group of controls. Obesity was not commonly associated with the disease while hypertension was associated with it about three times as often as in a control group.

The survival rate for patients with the disease was less favorable than that of a normal population of similar age and sex distribution. Those patients with aorto-iliac occlusion had significantly less favorable survival rates than those with femoral occlusion. In about three-fourths of those who died the cause of death was thought to be disease of the coronary arteries. The presence of atherosclerosis as demonstrated by coronary artery or cerebrovascular disease at the time of diagnosis of vascular disease of the extremities, adversely affected the survival rate.

Four per cent of the patients needed an amputation of a leg shortly after the diagnosis of arteriosclerosis obliterans was made. An additional five per cent required amputation during the five-year period following the initial examination. Only three per cent of the patients with intermittent claudication as the only symptom of their disease required an amputation during this period. Eleven per cent of the patients who continued to smoke, but none who abstained from smoking, had amputations within the five-year period.

◇ **The Clinical Management of Congestive Heart Failure. Herrman L. Blumgart, and Paul M. Zoll. pp. 218-228.**

The chief therapeutic measures in congestive heart failure are rest, digitalis, diuretics, sedation, and oxygen therapy. Phlebotomy is often helpful.

The modern regimen of salt restriction, mercurial diuretics, and chlorothiazide has generally resulted in improved management, less disability, and increased longevity.

Marked salt restriction, particularly in patients with renal disease, has caused weakness, anuria, and azotemia which if unrecognized may be fatal. Mercurial and other diuretic agents tend to increase the incidence of such reactions in susceptible patients.

In other patients with renal impairment, mercurial diuretics have caused a disproportionate loss of chloride with hypochloremic acidosis. Continued administration of chlorothiazide may lead to loss of potassium as well as other electrolytes.

These untoward complications may be avoided by awareness, early diagnosis, and quick correction of electrolyte imbalance.

Progress in prevention of streptococcal infection; improved treatment of syphilis, and bacterial endocarditis; and improved control of arterial hypertension have all produced better management of congestive heart failure.

Abnormal electrocardiograms in apparently healthy people. I. Long-term follow-up study. *Mathewson, F. A. L., and G. S. Varnam. p. 196.*

Abnormal electrocardiograms in apparently healthy people. II. The electrocardiogram in the diagnosis of subclinical myocardial disease. Serial records of thirty-two people. *Mathewson, F. A. L., and G. S. Varnam. p. 204.*

The correction of hyponatremia in congestive heart failure. *Luckey, E. Hugh, and Albert L. Rubin. p. 229.*

The correlation between the electrocardiographic patterns of ventricular hypertrophy and the anatomic findings. *Scott, Ralph C. p. 256.*

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EXPERIMENTAL NEUROLOGY. *Vol. 2, Feb. 1960.*

◇ **Response of Muscle Spindles to Stimulation of the Sympathetic Trunk. Earl Eldred; H. Norman Schnitzlein, and Jennifer Buchwald. pp. 13-25.**

The concept that intrafusal fibers may receive motor innervation from sympathetic fibers is not a settled fact. The afferent discharge from muscle spindles may be influenced by the sympathetic nervous system. The possibility, however, that this influence is only indirect, through alterations in blood flow and not due to direct sympathetic innervation has been investigated by the authors.

Examination was made on the discharge of receptors of otherwise de-efferented gastrocnemius muscle of adult cats. Firing of units was monitored from fine dorsal root filaments while electrical stimuli were given to the distal stump of one lumbar sympathetic chain.

Fifteen or more seconds after repetitive stimulation a moderate and gradual rise in discharge frequency developed, followed by a depression or cessation of abrupt onset. Similar effects following sympathetic stimulations are shown by tendon organs, which have no motor component. Since blood flow through the leg was markedly reduced during stimulation, a comparison was made between the response to sympathetic stimulation and that to vascular occlusion. Restriction of arterial supply to the limb by pressure occlusion of the arteries or through vasoconstriction induced by close arterial injection of adrenergic drugs is accompanied by a pattern of change similar to that following sympathetic stimulation. The full pattern of response is not attained if this vasoconstriction is prevented by an adrenergic blocking agent. These observations suggest that the characteristic discharge alterations in the afferent fibers arose mainly as the indirect result of vasoconstriction.

An accelleratory effect of slight degree and slow onset is produced by sympathetic stimulation following administration of the adrenergic blocking agent phenoxybenzamine and by small intra-arterial injection of epinephine. This response is considered to be due to sensitization of sensory endings by circulatory adrenergic substances rather than to direct motor innervation of intrafusal fibers.

In conclusion these experiments offer no support for a direct motor innervation of the incompletely striated fibers of muscle spindles.

◇ **A Comparison of the Psychological Test Performance of Patients with Focal and Non-focal Epilepsy. Allan F. Mirsky; Daniel W. Primac; Cosimo Ajmome Marsan; Henger Rosvold, and Janice R. Stevens. pp. 75-89.**

The present investigation was designed to study the performance of patients diagnosed on the basis of clinical and EEG criteria as having focal or non-focal epilepsy.

In a preliminary pilot study, 10 epileptic subjects, five with focal EEG abnormality of the temperal lobe, the other five with non-focal epilepsy, were examined. Of the several tests employed, only the Memory Quotient-Intelligence Quotient difference scores discriminated significantly between the two groups. The study suggested that patients with temporal lobe epilepsy perform more poorly than patients with centrencephalic or diffuse epilepsy on a test of memory and that the reverse might be true on a test of attention.

The memory and attention test were therefore administered to a larger sample of epileptic patients. There were two groups of patients with diagnoses of focal involvement: 39 with temporal lobe and 18 with frontal lobe epilepsy. The third group, the centrencephalic, consisted of 19 patients. The several groups were matched by statistical means to control for differences in intelligence, age, duration of illness, seizure frequency and amount of EEG abnormality. When analyzed in this manner the memory test revealed no significant variation among the temporal, frontal and centrencephalic groups. A difference, however, was present on the test of attention. The non-focal centrencephalic patients performed more poorly than the focal patients or the control group. There were no significant differences among the temporal, frontal and control groups. It appeared clear that individuals with diffuse and bilaterally synchronous electrographic abnormality are impaired in attentiveness as measured by the Continuous Performance test. The inconsistent results on the memory test are analyzed in relation to the duration of the illness. The authors suggest that the memory dysfunction with temporal lobe epileptogenic foci may not be manifested unless the disorder has been present for an appreciable length of time, possibly in excess of 10 years. The impairment of the non-focal patients on the attention test is interpreted in terms of the Pensfield and Jasper hypothesis of subcortical dysfunction in the centrencephalic type of epilepsy.

Effects of unilateral sympathectomy on the contralateral pupil of the cat. *Guth, Lloyd, and Clark J. Bailey. p. 90.*

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INTERNATIONALE ZEITSCHRIFT FUR ANGEWANDTE PHYSIOLOGIE. *Arbeitsphysiologie. Vol. 18 (Part 2), Jan. 15, 1960.*

◇ **An Indirect Method of Recording Comfort of the Seated Subject. E. Grandjean; M. Jenni, and A. Rhiner. p. 101 (text in German).**

The authors have used an ingenious device consisting of a platform mounted on springs holding the chair to be tested. Movement of the subject in the chair causes motion of the platform which is recorded automatically. They found that subjective responses correlated with the recorded data, discomfort being associated with greater movement, comfort with less movement.

There were variations in number of movements between subjects which were significantly different for a given type of chair or position of backrest. Nonetheless, the differences recorded for a given subject varied significantly with variations of type of chair or position of the backrest.

◇ **The Effect of Muscular Work on Serum Aldolase Activity in Trained and Untrained Man. C. H. Wyndham; N. B. Strydom; H. M. Cooke, and J. S. Maritz. p. 112.**

The authors studied the changes of serum aldolase following exercise in untrained subjects who subsequently had short training periods and in subjects kept in training for 50 days. They found the level increased following exercise in both groups, and it returned to normal in about 75 minutes. The levels were constantly higher in trained than in untrained subjects, and decreased to pretraining levels within two to three days after cessation of training. No correlation was found between serum aldolase activity and serum potassium levels on protein levels throughout training.

Measurement of the recovery time following static work in humans. *Rohmert, W. p. 123 (text in German).*

Pathogenesis and prophylaxis of "Bends" in high altitude fliers (part 3): Intravascular formation of gas bubbles on sudden decrease of atmospheric pressure following accommodation to high altitude. *Wunsche, O. p. 165 (text in German).*

Strength of the arms of adults standing in various positions. *Rohmert, W. p. 175 (text in German).*

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THE JOURNAL OF BONE AND JOINT SURGERY. *Vol. 42-A, Mar. 1960.*

◇ **Clinical Experiences with the S.A.C.H. Foot Prosthesis. Everett J. Gordon, and Joseph Ardizzone. pp. 226-234.**

The S.A.C.H. prosthetic foot was developed at the University of California at Berkeley in 1955. The ankle and foot are combined into one component firmly attached to the shank of the leg by a carriage bolt. The foot is composed of a hardwood keel shaped at the ball of the foot to provide rocker action and a cushioned heel of multiple laminations of neoprene and sponge rubber.

When walking with the S.A.C.H. foot, plantar flexion is simulated by the spring resulting from compression of the cushion heel. As the body weight is carried over the foot in the stance phase the roll over is smoothly carried through on the keel, with this rocker action also facilitating push-off.

The S.A.C.H. foot was prescribed for 123 amputees with lower extremity prostheses varying from the Canadian-hip-disarticulation type to the Symes amputation prosthesis. All but five per cent enthusiastically approved of the substitution for their previous type of foot.

The principal advantages noted were the shock absorption at heel strike, with the resultant reduction in jarring and irritation of the stump and the reduced maintenance required.

The major disadvantage is the instability resulting from the compressible heel. For this reason the bilateral amputee should probably not have this prosthetic foot.

◇ **Chronic Neurological Sequelae of Acute Trauma to the Spine and Spinal Cord. Part V. The Syndrome of Acute Central Cervical Spinal-Cord Injury Followed by Chronic Anterior Cervical-Cord Injury (or Compression) Syndrome. Richard C. Schneider. pp. 253-260.**

Case histories are presented of two patients with cervical hypertrophic arthritis who sustained acute central cervical spinal-cord injuries without fracture or dislocation of the cervical spine. Both patients recovered from the neurological deficits of the acute injury only to develop a chronic anterior cervical spinal-cord compression syndrome more than one year later.

The late developing symptoms consisted of increasing spasticity and weakness of the extremities with bilateral hyperreflexia and extensor plantar reflexes. In the first patient the distribution of the hypesthesia suggested involvement of cervical-nerve roots while in the second there was a dermatomal sensory level indicating anterior spinal-cord compression.

It was suggested that the symptoms were due to localized compression of the anterior spinal cord in the midline by hypertrophic spurs with secondary zones of stress in the lateral corticospinal tracts due to the pull of the denticulate ligaments at their insertions.

Early and late roentgenograms were available in the second patient which demonstrated the development of progressive bone changes. In both patients cervical myelograms in neck

extension showed compression of the cord between a hypertrophic spur anteriorly and a wrinkled ligamentum flavum behind, which emphasizes the need for careful handling of these patients to avoid further spinal cord damage.

Both patients were much improved following cervical laminectomy with removal of the protruding bone spurs and ridges.

Correlation of the myelogram with clinical and operative findings in lumbar disc lesions. *Lansche, W. Edward, and Lee T. Ford. p. 193.*

Experimental excision of muscles in the weanling rat. *Cohen, Jonathan, and Marvin S. Weinfeld. p. 278.*

Anterior spine fusion for the treatment of tuberculosis of the spine. The operative findings and results of treatment in the first one hundred cases. *Hodgson, A. R., and Francis E. Stock. p. 295.*

The talar-tilt angle and the fibular collateral ligaments. A method for the determination of talar tilt. *Rubin, Gustav, and Morris Witten. p. 311.*

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JOURNAL OF CHRONIC DISEASES. *Vol. 11, Jan. 1960.*

◇ **Systemic Lupus Erythematosus. Paul Altrocchi. pp. 34-49.**

Systemic lupus erythematosus is a diffuse disease characterized by a severe alteration in the nucleoprotein of connective tissue nuclei and white blood cells. Secondarily, there is damage to ground substance and then distortion of the structure and function of many organ systems. Recent histochemical evidence suggests that the protein moiety of the nucleoproteins is the probable site of the pathologic changes.

Hematoxylin bodies, hyaline thrombi, wire-loop lesions, fibrinoid material, and lupus erythematosus cells are discussed. These lesions are now considered to be degradation products of nucleoprotein. Thus, hyaline thrombi are thought to be a circulating later stage of hematoxylin bodies and lupus erythematosus cells. After passing through vessel walls where a non-specific arteritis may be evoked, this material is further degraded and may be deposited as wire-loop lesions in the kidney and after most or all of the desoxyribo nucleic acid has disappeared, as fibrinoid material in the ground substance of many tissues, fibrin is finally deposited as a local reaction to tissue damage and inflammation. The relation of gamma-globulin to the disease is reviewed and meager evidence is presented to suggest that lupus erythematosus is an autoimmunity disease.

◇ **Clinical Experience with Zoxazolamine as a Uricosuric Agent in Gout. A. Lewis Kolodny. pp. 64-68.**

The effect of zoxazolamine was studied in 11 ambulatory patients with gout in the acute, intercritical, and chronic stages over a period of 27 weeks. The drug was given for periods of three to 16 weeks in doses varying from 250 mg. once a day to 500 mg. four times a day. Probenecid, salicylates, and phenylbutazone were given intermittently in order to determine any inhibition or potentiation of the activity of zoxazolamine.

The drug produced marked uricosuric effects in a dosage of 250 mg. two to four times a day. Clinically, 10 of 11 patients were controlled or improved on this dosage. The other subject improved but died of uremia after zoxazolamine had been discontinued. Salicylates seemed to interfere with the action of zoxazolamine to some extent while phenylbutazone and probenecid accentuated its effect. Acute attacks were far less frequent on 250 mg. twice a day than with previous therapy. Tophi decreased markedly in size and side effects were minimal. In three patients with renal damage zoxazolamine precipitated acute attacks in spite of maintained uricosuric activity.

The author concludes that the drug is potent, effective and non-toxic in the treatment of gout in the intercritical and chronic stages. For the acute attack colchicine is still the drug of choice.

Postherpetic pain. *Crikelair, George F., and Francesco Minervini. p. 69.*

Patients on home care: their characteristics and experience. *Goldmann, Franz, and Marta Fraenkel. p. 77.*

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THE NEW ENGLAND JOURNAL OF MEDICINE. *Vol. 262, Mar. 3, 1960.*

◇ **Radiation Reaction in the Lung: Report of a Fatal Case in a Patient With Carcinoma of the Lung. With Studies of Pulmonary Function Before and During Prednisone Therapy. T. Rodman; S. Karr, and H. P. Close. pp. 431-434.**

The authors present a case in which a severe radiation reaction in the lung followed x-ray treatment by a rotational technic for an anaplastic bronchogenic carcinoma, located in the upper mediastinum. Studies of the pulmonary functions were done shortly after admission. All lung volumes were markedly reduced, but the timed vital capacity, maximum breathing capacity and maximum expiratory flow rate were normal. There was marked arterial oxygen unsaturation, a slightly increased pH and a reduced partial pressure of carbon dioxide. The patient was hyperventilating at rest, consumed only 22 ml. of oxygen per liter of ventilation and showed an exaggerated ventilatory response to exercise. These findings suggested the presence of restrictive lung disease with an associated diffusion defect with no airway obstruction. The patient was treated with prednisone, 10 mg. four times daily. There was immediate and remarkable subjective improvement, but the pulmonary function tests became slightly worse while the patient was receiving prednisone. The patient died 48 days after admission. Rotational x-ray therapy should be used only when the lesion to be irradiated can be encompassed with a narrow portal. Adrenocortico-steroids do not alter the progress of a radiation reaction although subjective symptoms may be ameliorated.

◇ **Bacteriuria and Urinary-Tract Infections in Hospitalized Patients. A. Kaitz, and E. J. Williams. pp. 425-430.**

The authors report on an investigation of bacteriuria and urinary-tract infections in hospitalized patients. Satisfactory cultures were obtained from 309 unselected patients on admission. Colony counts were done within 48 hours by a pour-plate method. Significant bacteriuria, defined as more than 100,000 pathogenic bacteria per ml. of urine, was present in 17.2 per cent of the patients. Bacteriuria varied with age and sex. Below 70 years of age the incidence of bacteriuria in males was about 7.5 per cent, and 15 per cent in females. Over seventy years the figure for males rose to about 20 per cent, and that for females to 30 per cent. All cases of bacteriuria were due to gram-negative bacilli.

There was a 100 per cent correlation between bacteriuria in men and a prior history of urinary-tract instrumentation. About 50 per cent of the women with bacteriuria on admission did not have a history of instrumentation. A prior history of a urinary-tract infection was more common in the women with bacteriuria. About one-third of the patients of both sexes without bacteriuria on admission also had a prior history of urinary-tract instrumentation. In the group of patients without bacteriuria on admission, all the urinary-tract infections occurred after catheterization; 32 per cent of catheterized patients acquired urinary-tract infections. In the group with bacteriuria on admission, about an equal number of clinical infections occurred before and after catheterization. Patients with bacteriuria on admission had almost six times as many urinary-tract infections as those without bacteriuria on admission.

Of 17 patients who received chemotherapy for bacteriuria, 12 still had positive follow-up cultures. Twelve of 16 women with bacteriuria on admission had spontaneous reversal to low counts without treatment. There was a positive correlation for bacteriuria in males with albumin-uria and blood urea nitrogen over 20 mg. per 100 ml. Asymptomatic bacteriuria, symptomatic urinary-tract infections and impaired renal function appear to be related. More frequent detection and study of patients with bacteriuria will lead to more effective treatment and to a better understanding of the clinical importance of this finding.

PEDIATRICS. *Vol. 25, Mar. 1960.*

◇ **Conservative Management of Acute Renal Failure. S. A. Kaplan; J. Strauss, and A. M. Yuceoglu. p. 409.**

Acute renal failure, a term used interchangeably with "lower nephron nephrosis," is rarely reported in children although it may occur much more frequently than is suspected. The authors report on the treatment of three children and six adults. Two of the children survived, one died. The essentials of the treatment program which did not include use of an artificial kidney included administration of only enough water to cover insensible loss plus volume of urine voided in the previous 24 hours in the early phases, restriction of sodium intake, use of potassium exchange resins for hyperkalemia, adequate caloric intake, management of calcium and phosphate levels, and treatment of congestive heart failure. In view of the fact that seven of nine patients have survived a disease usually associated with high mortality rate, the authors' regimen is well worth attention.

◇ **Congenital Nonhemolytic Icterus With Damage to the Central Nervous System. Gene L. Whitington. p. 437.**

This is a report of progressive spasticity in a negro child with jaundice noted first at 14 days of age. The cause of bilirubinemia is obscure in spite of a variety of studies to establish the etiology. In contrast with previously reported cases, there is not evidence of a familial trait. Bilirubin was present in the bile obtained during laparotomy. The extrahepatic biliary tract was normal. Liver was normal, as were tests for blood type incompatibility, toxoplasma and syphilis. In this case as in almost all previously reported instances of children with similar syndromes there is damage to the central nervous system. One previously reported child showed jaundice on the second day of life but neurologic symptoms did not occur until three years of age.

Radiation hazards in diagnostic radiology. *Caffey, John. p. 359.*

The influence of exogenous iron on formation of hemoglobin in the premature infant. *Hammond, Dennan, and Arlene Murphy. p. 362.*

Epilepsy, light-sensitivity and left-handedness in a family with monozygotic triplets. *Herrlin, Karl-Magnus. p. 385.*

Seitelberger's spastic amaurotic axonal idiocy. *Nakai, Hisayo; B. H. Landing, and W. K. Schubert. p. 441.*

Preventive implications of a study of 100 poisonings in children. *Jensen, G. D., and Wesley W. Wilson. p. 490.*

Intravenous fluid therapy for infants and children. Physiologic principles and a practical regimen with examples of application. *Bruck, E.; T. Aceto, Jr., and C. U. Lowe. p. 496.*

Congenital coronary arteriovenous fistula. *Gasul, B. M.; R. A. Arcilla; E. H. Fell; J. Lynfield; J. P. Bicoff, and Lawrence Luan. p. 531.*

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JOURNAL OF NEUROPHYSIOLOGY. *Vol. 23, Jan. 1960.*

◇ **Localization and Patterns of Discharge of Respiratory Neurones in Brain-Stem of Cat. G. C. Salmoiraghi, and B. Delisle Burns. pp. 2-13.**

Twenty-three cats weighing 1.5 kg. to 3.0 kg. were anesthetized with intraperitoneal sodium pentobarbital (35 mg./kg.) or with ethyl chloride followed by ether. After tracheal intubation and occlusion of the common carotid arteries the cerebellum was removed and a midcollicular decerebration was performed. Systematic exploration of the brain-stem was carried out with glass micropipettes having an internal diameter at the tip of 1 μ to 8 μ, filled with 0.5 or 0.9 saturated NaCl solution in water and with a D.C. resistance in saline from 0.3 to 3.0 megohms.

The purpose of this study was to locate the somata of respiratory neurones and record action potentials from them. These neurones were defined as those showing periodic bursts of action potentials in phase with either expiratory or inspiratory movements. They were found in the floor of the fourth ventricle predominantly at the level of the acoustic striae. Inspiratory and expiratory neurones were not segregated, but were intermingled within the same region. The inspiratory neurones were found twice as often, in 148 stabs with the microelectrodes, as the expiratory neurones. The plot of the mean frequency of discharge of the average expiratory and inspiratory neurone throughout the respiratory cycle revealed an inverse relationship between them.

◇ **Notes on Mechanism of Rhythmic Respiration. G. C. Salmoiraghi, and B. Delisle Burns. pp. 14-26.**

Cats of 3 kg. to 4 kg. in weight were prepared as described in the previous abstract. The effect of various surgical sections through the brain-stem and cranial nerves upon the activity of the respiratory neurones was then studied by means of microelectrodes and oscillographic recording.

Complete division of the brain-stem into two halves by a midline section from the midcollicular level to the level of the first cervical segment caused all respiratory movement to stop without ending the periodic activity of the respiratory cells in the medulla. A four millimeter midline section in the region of the obex was enough to stop respiratory movements.

Periodic firing of respiratory neurones was maintained in the absence of periodic activity in vagal and proprioceptive afferent pathways. Progressive isolation of the brain-stem produced a

progressive decline in the number of periodically active respiratory neurones which could be found. In the partially isolated brain-stem a transient burst of activity could be produced in neurones found in the respiratory area by a short period of direct excitation at the caudal end of the medulla.

The authors conclude from these experimental results that no evidence exists for respiratory pacemaker cells which can fire spontaneously in the absence of activity in other neighboring neural pathways.

Repetitive firing of respiratory neurones during their burst activity. *Burns, B. Delisle, and G. C. Salmoiraghi. p. 27.*

Postural reflexes in forelimb of toad, Bufo marinus. *Chambers, Roger M., and Jonathan P. Simcock. p. 54.*

Cerebral response in somatic area I of ipsilateral somatic II origin. *Makahama, Hiroshi. p. 74.*

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JOURNAL OF PEDIATRICS. *Vol. 56, Mar. 1960.*

◇ **Epilepsy in the Families of Epileptics. Victor Eisner; Lydia L. Pauli, and Samuel Livingston. p. 347.**

A group of 669 patients with epilepsy and 470 other patients without epilepsy were investigated for the presence of epilepsy in their immediate families. Of the various divisions which the authors make, only patients with idiopathic major motor epilepsy showed a greater incidence of seizures. The other classes of seizures defined in detail were organic major motor, focal, petit mal, minor motor, and psychomotor. The only factor in the history or findings on these patients which the authors correlated well with incidence of seizures in relatives was the age of onset of convulsions. They state the highest risk was found to occur in close relatives of probands who had developed major motor epilepsy before 3½ years of age: 7.6 per cent of these relatives may be expected to develop major motor seizures by 19½ years of age, and 9.4 per cent by 39½ years of age. Comparable control risks were 1.4 and 2.3 per cent.

◇ **Pseudohypoparathyroidism and Pregnancy. Herbert Hershberg, and Alvin C. Wesely. p. 383.**

The authors followed the first pregnancy of a 25-year-old patient who was first noted at age 14 to have low serum calcium and high serum phosphorus levels and who did not have phosphorus diuresis following injections of parathyroid extract. She was treated with dihydrotachysterol, then calciferol, and subsequently was able to go without these medications. She continued with occasional tingling and numbness which was readily controlled by calcium gluconate. During the second and third trimester she also received calcium gluconate daily, and during the third trimester she also received 500 units of Vitamin D daily because of paresthesia. A normal female child was delivered in good condition by caesarian section because of cephalopelvic disproportion. At the time of the report the child was 14 months old, appeared normal, although there were transient changes in calcium and phosphorus levels in the newborn period.

Hydrocephalus. *Ransohoff, Joseph; K. Shulman, and R. A. Fishman. p. 399.*

Etiology of mongolism. *Warkany, Josef. p. 412.*

Epidemic nephritis in South Trinidad. *Symonds, B. E. R. p. 420.*

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THE NEW ENGLAND JOURNAL OF MEDICINE. *Vol. 262 (Jan. 14) 1960.*

◇ **Treatment of Staphylococcal Septicemia with Vancomycin. W. Kirby; D. Perry, and A. Bauer. pp. 49-55.**

This report presents the results of 33 cases of staphylococcal septicemia treated with vancomycin over a period of 19 months. Most of the infections occurred in elderly, debilitated patients, who had serious underlying diseases. In all but one patient one or more blood cultures were positive for staphylococci. Vancomycin was supplied as a powder in 0.5 gm. ampoules, and 10 ml. of sterile distilled water was added to each ampoule. This concentrated solution was further diluted in 100 to 200 ml. of 5 per cent dextrose in distilled water and was administered as an intravenous infusion over a period of 20 to 30 minutes. The maximum daily dose of vancomycin was 2 gm. administered in 1 gm. doses every 12 hours.

Twenty patients were cured. Most were seriously ill, and many had failed to respond to other antibiotics. In some patients there was an almost immediate response to vancomycin; a fall in temperature and marked subjective improvement in 24 to 48 hours was noted. In others there was little evidence of improvement either subjectively or objectively during the first two or three days, and thereafter the temperature gradually declined to normal levels. In most of the patients the blood cultures were all negative after treatment was started. In six patients improvement occurred with vancomycin therapy. The temperature declined, and the blood cultures were negative. Each of these patients subsequently died of the underlying disease.

Seven cases are classified as treatment failures. Most of these patients had overwhelming infections and died shortly after treatment was started. Side effects, consisting of chills, fever and rashes, occurred in a small percentage of patients and could usually be controlled by slower administration and by the addition of antihistamines or steroids. The effectiveness of vancomycin is attributable to the fact that staphylococci are uniformly susceptible. The antibiotic is bactericidal in action, high serum and tissue concentration can be readily attained and resistance of staphylococci to vancomycin develops slowly if at all.

◇ **Peripheral Entrapment Neuropathies of the Lower Extremity. H. Kopell, and W. Thompson. pp. 56-60.**

This publication reviews the entrapment neuropathies in the lower extremities. An entrapment point occurs in the course of a nerve where the anatomic configuration may cause constriction of the nerve, or if trauma has occurred to the area, the particular anatomic disposition will maintain the nerve in a state of inflammation. A significant characteristic of these neuropathies is pain during rest which frequently becomes more severe at night. The pain is usually peripheral to the entrapment point. Tenderness is present at the entrapment point, and the nerve trunk is often tender both proximal and distal to this area. Skin sensation as well as muscular atrophy and weakness can be present. Continuing nerve irritation at the entrapment point may lead to a secondary autonomic-nervous-system hyperfunction. Entrapment of the sciatic nerve may occur at the level of the sciatic notch. The relation of the nerve to the bone at this point can be influenced by altered spatial relations of the spine, pelvis and femur. An increase in lordosis with compensatory hip flexion will tighten the nerve trunk against the rim of the bone.

The obturator nerve can be entrapped in the obturator canal. It is the fibrous edge of the obturator membrane and the derived fascial investiture that forms the critical inelastic component of this pathway. Entrapment neuropathy at this point can be the major source of pain in osteitis pubis. The lateral femoral cutaneous nerve is subject to an entrapment phenomenon where it pierces the attachment of the inguinal ligament just below the anterosuperior spine. This neuropathy is known as meralgia paraesthetica. The peronal nerve is vulnerable to an entrapment phenomenon in its course around the fibular neck. Weakness in the dorsiflexors and skin sensory defects on the lateral portion of the leg and dorsal portion of the foot may be the result.

The posterior tibial nerve is vulnerable to entrapment phenomenon in the retromalleolar compartment. This neuropathy can be the reason for a painful heel after a severe heel bruise. Entrapment of the plantar nerves can occur under the spring ligament and the quadratus plantae muscle, and entrapment of the digital nerves can occur where they are crossed by the transverse intertarsal ligament. It is useful to keep the entrapment phenomenon in mind in the differential diagnosis of symptoms arising from more central neurologic sources.

The thyroid gland. *Hamolsky, M., and A. Freedberg. p. 70.*

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THE NEW ENGLAND JOURNAL OF MEDICINE. *Vol. 262 (Jan. 21) 1960.*

◇ **Clinical Value of Liver Photoscanning. D. Fee, and S. Fedoruk. pp. 123-125.**

From a diagnostic point of view it is desirable to develop some method of outlining the liver to demonstrate its position, shape, size and if possible, the presence of tumors or gross disease in its substance. The authors present some of the results obtained from a series of 250 photoscans of the liver, using radioactive rose bengal dye. A Reed-Curtis Scintiscanner was used for the examination. Rose bengal dye is quickly concentrated in the polygonal cells of the liver and completely excreted into the small intestine in a few hours. It is not taken up by metastases or scar tissue. Where there is a normal concentration of the dye in the liver the emitted radiation will cause the light source to "blacken" the film, and in areas of decreased uptake the film will appear "white" or relatively underexposed.

The radioactive dye was administered intravenously 20 minutes before scanning. The activity used was 2.5 to 3.0 microcuries per kilogram of body weight. In some cases liver metastases

from a primary tumor elsewhere were suspected, and in others the clinical evidence of deposits was definite. Some patients had an undiagnosed mass in the upper abdomen. The question whether or not the liver was enlarged was in dispute. The demonstration of a normal liver, without defects and in its normal position, was often found to be of definite diagnostic value by excluding this organ as the cause of the mass in question. The whole procedure caused no discomfort or reaction to any of the patients.

◇ **Severe Urticaria Following Erythromycin Therapy. A. S. Prasad. pp. 139-140.**

Erythromycin is believed to cause no serious reactions. After large doses, nausea, vomiting, and occasionally abdominal pain and diarrhea may occur. According to Kagan and Faller no allergic reaction to erythromycin has been reported. Phlebitis and thrombosis have been observed. In a report by Solomon and Johnston toxic reactions were recorded as being uncommon. In a large series of cases only one patient had a rash; another had fever that was possibly due to the drug. One had nausea and vomiting, and four had loose bowel movements under therapy. Among the 122 patients treated with erythromycin, therapy was stopped because of side effects in only one patient.

The author reports a case of urticaria so severe that erythromycin therapy was stopped. The patient had an operation for herniated intervertebral disc. After operation he received penicillin and streptomycin for prophylaxis, but fever developed 10 days later. On two occasions the blood culture was positive for coagulase-positive Staphylococcus albus. The patient received 250 mg. of erythromycin four times daily. On the next day severe urticaria and itching appeared, and the drug was stopped. A positive skin test was observed. The skin rash is believed to be an allergic reaction caused by the drug.

Parkinson law in medicine. *Takat, G. p. 126.*

The thyroid gland. *Hamolsky, M., and A. Freedberg. p. 129.*

Skull changes in infants with chronic iron-deficiency anemia. *Shahidi, T., and L. Diamond. p. 137.*

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THE NEW ENGLAND JOURNAL OF MEDICINE. *Vol. 262 (Jan. 28) 1960.*

◇ **The Magnesium-Deficiency Tetany Syndrome in Man. B. Vallee; W. Wacker, and D. Ulmer. pp. 155-161.**

This study describes a new specific clinical entity — human magnesium-deficiency tetany. This syndrome is virtually identical to that of hypocalcemia tetany, from which it can be differentiated only by chemical means. The concentration of magnesium in serum from normal subjects is ranged from 1.75 to 2.49 mEq. per liter. Five patients with magnesium-deficiency tetany were studied. Simple dietary restriction of magnesium intake does not produce tetany, nor does prolonged debilitation do so, even though it brings about a negative magnesium balance and depletes the body stores of this element. Sustained losses of gastrointestinal secretions, prolonged parenteral fluid therapy or severe infections acted as conditioning factors to produce the syndrome in previously malnourished persons.

All the patients had tetany manifested by either spontaneous carpopedal spasm or positive Chvostek and Trousseau signs, convulsions, athetoid movements of the extremities and marked reaction to mechanical and auditory stimulation. The serum magnesium concentration of all five patients was markedly depressed. The concentrations of calcium, sodium and potassium were normal. In all five patients parenteral administration of magnesium sulfate promptly and completely reversed the symptoms, signs, and chemical changes of the disease. The biochemical and physiologic mechanisms by which an imbalance of either calcium or magnesium produces tetany are unknown. In their discussion the authors comment on various possibilities.

Toxoplasmosis in the adult. *Remington, J.; L. Jacobs, and H. Kaufman. p. 180.*

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THE NEW ENGLAND JOURNAL OF MEDICINE. *Vol. 262 (Feb. 4) 1960.*

◇ **Antibiotic Combinations: Antibacterial Action of Serum After Ingestion of Novobiocin or Tetracycline or Both. H. Hirsch, and M. Finland. pp. 209-214.**

A controlled study was performed to determine the effect of the administration of novobiocin in combinations with tetracycline on the antibacterial activity of the serum of eight normal young men as measured in a twofold-dilution test in broth using four test strains that were sensitive to one or both of these antibiotics. Synergistic effects of this combination in a 1:2

or 2:1 ratio were not observed in the control tests of the sensitivity of these strains in vitro and the combined effect could be considered additive or indifferent. The same thing was true of the activity of the serum after ingestion of these antibiotics by the same subjects in these ratios, as compared with the same amounts of the individual drugs. However, the administration of 500 mg. of tetracycline with 250 mg. of novobiocin resulted in a lower antibacterial activity in the serum against a tetracycline-resistant staphylococcus as compared with the dose of 250 mg. of novobiocin alone. These effects were confirmed by assays of the novobiocin and tetracycline content of the same serum done by an agar-diffusion technic employing different assay organisms.

◇ **Some Effects of Ankylosing Spondylitis on Pulmonary Gas Exchange. A. Renzetti; W. Nicholas; R. Dutton, and L. Jivoff. pp. 215-218.**

The pulmonary function was studied in 12 men with ankylosing spondylitis but without evidence of lung or heart disease. X-ray films of the chest were normal both in the appearance of the lung fields and in the position of the diaphragm. The excursion of the diaphragm was good. Pain was minimal at the time of pulmonary-function study. Lung volume, maximal ventilatory capacity, index of intrapulmonary mixing, ventilation and gas exchange at rest, during and after a standard exercise were measured. The most frequent finding was a mild to moderate reduction in vital capacity and total capacity. Hyperventilation of moderate to marked degree was present at rest in all but two studied as well as during and after exercise in many of the group. Excepting three patients, this hyperventilation resulted entirely from an increase in respiratory rate rather than an increase in tidal volume. Mild arterial oxygen unsaturation at rest or after exercise was present in half the group. The most unusual finding was an increase in the physiologic dead space in every patient. The percentage of venous admixture was increased in five of the six patients studied. The arterial carbon dioxide tension and alveolar ventilation were normal in all.

The lung volume changes observed in this study are in agreement with those reported by Rogan and co-workers. It seems that the vital capacity may well be used as an objective criterion for the evaluation of the severity of the disease. It is suggested that the hyperventilation and pulmonary gas exchange defects might result from relative overexpansion of the lower and underexpansion of the upper portions of the lung.

A review of the melancholy of anatomy. *Spector, B. p. 234.*

Toxoplasmosis in the adults. *Remington, J.; L. Jacobs, and H. Kaufman. p. 237.*

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THE NEW ENGLAND JOURNAL OF MEDICINE. *Vol. 262, Feb. 11, 1960.*

◇ **Alveolar Gas Exchange in Clinical Pulmonary Embolism. E. Robin; C. Forkner, Jr.; P. Bromberg; J. R. Croteau, and D. Travis. pp. 283-287.**

In this report the authors investigate the derangement of the gas-exchange functions of the lung in pulmonary embolism. Eleven patients were studied during the acute phase of their illnesses. In all the diagnosis of pulmonary embolism was reasonably certain. All of the patients were studied with the various pulmonary function tests. It was found that three major abnormalities occur in the gas exchange of the lung. One is the development of arterial oxygen unsaturation (three of the mechanisms for oxygen unsaturation are venoarterial shunting, decreased diffusing capacity of the lung and relative alveolar hypoventilation). A second abnormality is the development of hyperventilation. Hyperventilation serves the purpose of assisting normal arterialization of pulmonary capillary blood. The exact mechanisms subserving hyperventilation are not known. The third abnormality is the development of significant differences between the carbon dioxide tension of arterial blood and end-tidal air. This is produced by dilution of alveolar air by the newly formed dead space. Careful studies of gas exchange provide useful information in the diagnosis of pulmonary embolism.

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THE NEW ENGLAND JOURNAL OF MEDICINE. *Vol. 262, Feb. 18, 1960.*

◇ **Comparison of the Recurrence Rate of Rheumatic Carditis Among Children Receiving Penicillin by Mouth Prophylactically or on Indication: A Six-Year Study. W. Lim, and M. Wilson. pp. 321-324.**

The American Heart Association recommends that "all individuals with a well established history of a previous attack of rheumatic fever or chorea, or who show definite evidence of rheumatic heart disease, should be placed on continuous prophylaxis throughout life or until new knowledge makes this recommendation invalid."

This study was undertaken to determine whether rheumatic carditis could best be prevented by continuous oral administration of penicillin or by therapeutic administration of penicillin on indication; such as onset of a respiratory infection as suggested by rhinitis accompanied by cough, sore throat associated with headache, malaise and fever, or evidence of injected fauces, tonsillitis and adenitis on examination. Considerable difficulties are often encountered in continuous oral penicillin prophylaxis.

One hundred and ten children (Group 1) received continuous oral prophylaxis for a total of 2,630 patient-months. In an estimated five per cent of the total-patient months there were occasional omissions of medication. One hundred and three children (Group 2) received penicillin therapeutically for ten days at the onset of any respiratory infection during a total of 2,744 patient-months.

There were few reactions attributable to penicillin therapy. The recurrence rate was found to be 6.6 per thousand patient-months in Group 1, as compared to 2.9 per thousand patient-months in Group 2. The significantly higher recurrence rate obtained for patients receiving continuous penicillin was due to the inclusion of a greater number of more susceptible children with recent attacks. When the recurrence rate was calculated according to age and interval since last attack there was no significant difference between those on continuous and on indicated therapy. For children under close medical supervision, continuous oral penicillin prophylaxis has no advantage over adequate penicillin therapy as indicated.

◇ **Severe Extrapyramidal Motor Activity Induced by Prochlorperazine: Its Relief by the Intravenous Injection of Diphenhydramine. W. Waugh, and J. Metts, Jr. pp. 353-354.**

Phenothiazine derivatives are currently widely used as potent tranquilizing and antiemic agents. Extrapyramidal motor reactions are very common side effects. As a rule they can be effectively controlled by sedation or by the administration of such drugs as trihexyphenidyl, benztropine, procyclidine and cycrimine. The authors describe a case of severe extrapyramidal motor reaction with life-threatening respiratory distress and laryngospasm following prochlorperazine therapy. Intravenously administered diphenhydramine afforded prompt therapeutic relief. Since certain of the antihistaminic drugs such as diphenhydramine, promethazine and chlorphenamine are effective central ganglioplegic agents or anti-Parkinsonism drugs, their use for the drug-induced extrapyramidal syndromes appears warranted.

The challenge of medical-care insurance: An essay of principles, philosophies and practices. *Lee, Jr., C. M. p. 332.*

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THE NEW ENGLAND JOURNAL OF MEDICINE. *Vol. 262, Feb. 25, 1960.*

◇ **Life-Threatening Poliomyelitis: Boston, 1955. B. Ferris; P. Auld; L. Cronkhite; H. Kaufmann; R. Kearsley; M. Prizer, and L. Weinstein. pp. 371-380.**

In this paper the authors present their experiences with the life-threatening types of poliomyelitis from the 1955 epidemic in Boston. Life-threatening types of poliomyelitis are the polioencephalitis, bulbar poliomyelitis, respiratory muscle weakness or any combination of these.

Pure encephalitis due to poliomyelitis was diagnosed only in the younger groups and it carried no mortality. Pure bulbar poliomyelitis and pure spinal poliomyelitis with respiratory-muscle involvement had low mortalities. The combined forms of poliomyelitis carried a high mortality, which occurred in both males and females at all age groups. The mortality rates for males and females did not differ significantly. Similarly, the fatality rates of the combined forms did not show any significant difference with age. Older patients had a relatively higher incidence of the combined forms and therefore a higher over-all mortality. The youngest group (under four years of age) also showed a high over-all mortality rate, owing largely to a relatively high mortality in the spinal respiratory type. The number of observed complications per patient increased with increasing age. Complications such as mediastinal emphysema, pneumothorax, pulmonary edema, hypertension, hypotension and thrombophlebitis had a high mortality. Eighty-five per cent of the deaths occurred in the first 20 days after admission to the hospital. Tracheotomies were performed in 112 cases, with a 50 per cent mortality in this group. In general the criteria for tracheotomy were inability to handle secretions by more conservative methods and laryngospasm.

Breathing machines were used on 218 patients. This group carried a high mortality (31.2 per cent). Of those who survived a period of two years, 75.3 per cent were successfully weaned from all respiratory aids. Another 19.4 per cent was only partially weaned. The older groups were hospitalized longer than the younger groups. The average number of days in the hospital per two-year survivor for each age group varied from 90 to 331 days, with an over-all average of 149 days. Eighteen patients were still in the hospital two years after the onset of the disease.

◇ **Absorption of Orally Administered Neomycin and Kanamycin: With Special Reference to Patients with Severe Hepatic and Renal Disease. C. Kunin; T. Chalmers; C. Leevy; S. Sebastyen; C. Lieber, and M. Finland. pp. 380-385.**

Serum levels and urinary recovery of neomycin and kanamycin were determined in patients with and without cirrhosis of the liver or renal disease, and in patients with severe renal disease uncomplicated by cirrhosis who received these antibiotics orally. Patients without evidence of hepatic or renal disease had demonstrable levels of neomycin in the serum from one to eight hours after a dose of 4 gm. orally; the average peak level was 4.0 μg. per ml. and was noted at one hour. In similar patients after a single oral dose of 2.8 gm. of neomycin or 4 gm. of kanamycin (each was base equivalent but given as sulfate), an average of 0.6 or 0.7 per cent of the dose, respectively, is recovered from the urine in 24 hours.

In patients with cirrhosis of the liver and normal renal function receiving 8 gm. per day of the drug orally, serum levels of neomycin or kanamycin ranged from indeterminate to 8 or 9 μg. per ml. These patients excreted, on the average, 0.5 and 1.1 per cent of the administered daily dose of neomycin and kanamycin, respectively, and the amounts recovered on different days did not change on continued therapy. In patients with cirrhosis of the liver and azotemia receiving 8 gm. per day of the drug orally, the serum levels were generally higher than in those without renal failure. In those receiving neomycin, serum levels comparable to those evidenced in normal persons after parenteral therapy, were achieved in some cases. Patients with renal disease uncomplicated by cirrhosis of the liver absorbed and tended to retain neomycin longer than patients with normal renal function.

Hyperglycemia and glycosuria due to thiazide derivatives administered in diabetes mellitus. *Goldner, M.; H. Zarowitz, and S. Akgun. p. 403.*

By the London post. *Lister, J. p. 405.*

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abstracts

Care of Civilians Rendered Paraplegic by an Injury to the Spinal Cord or Cauda Equina. Donald Munro. New England J. Med. **261**:833 (Oct. 22) 1959.

The author calls to the attention of those concerned individuals who have been paralyzed due to an injury to the spinal cord and cauda equina; the inadequate care given these patients with a plea for more effective and better treatment in the future, minimum standard of medical therapy now available and suggestions for the reasons of the failure to meet minimum requirements have developed. Only patients whose paralysis is limited to body, legs, bladder and bowel are considered. As the result of the efforts of Betsy Barton, a civilian paraplegic and John G. Counsell, rendered paraplegic by World War II, programs for investigation treatment, social and work rehabilitation of such invalids were set up. However, interest today is at a low ebb. Care for veterans is provided through Paraplegic Centers of the VA, while civilian paraplegics have to resort to county hospitals. Those who are ineligible for treatment at the VA are treated by local doctors who do not have the time and service to devote to these patients who require prolonged hospitalization and who have little or no resources. Three case reports are given which illustrate the lack of interest and knowledge about paraplegic patients. As a result, bedsores developed, bladder and bowels were neglected, etc. The most tragic outcome of treatment of paraplegics is promises made to the families and patients when recovery from the paralysis is impossible. The paraplegic patient has the right to demand the following from his medical attendant: 1. diagnosis founded on facts; 2. statistical details of rehabilitation; 3. statistical end results, such as life expectancy, normal social life, gainful employability, complete self-care, control of the bladder at all times, complete freedom from bedsores and lastly, freedom from psychologic maladjustments. The patient in turn must agree to cooperate with his doctor, make a constant effort to increase his skills, activities, independence and mobilization and to undertake gainful labor if capable of doing so. It is the responsibility of the community to provide a sufficient number of beds in properly staffed and equipped hospitals and to permit long-term care of patients whenever necessary. There are three fundamental reasons for deterioration of medical care of paraplegics: 1. unwillingness of doctors to pay constant and unremitting attention to details; 2. obvious trend toward using easier therapeutic methods even though less accurate and less effective, and 3. resultant complacency which therapeutic half-successes are rationalized through specious arguments and lowering of standards of accomplishment. It is a fact that hospitals are now being operated in such a manner that their bed occupancy is assured of being fluid. The stimulus and leadership that will produce better care, less invalidism, a higher degree of rehabilitation and a return of the injured person to community participation and self-support must come from an aroused and forward-looking medical profession.

Injuries of the Hand. P. S. London. Medical World **91**:421 (Nov.) 1959.

The specialty of hand surgery has enhanced the status of the general practitioner since prompt recognition of injuries requiring special facilities by these practitioners has resulted in successful treatment. So-called "minor" injuries are often found to be of major importance. Stiff, swollen and/or painful joints should be x-rayed and tested before a diagnosis of sprain is made. It is safe to ignore displaced chips of bone, but unwise to ignore a wide separation or inversion of the fragment, since a serious tearing of ligament, capsule and tendon sheath is indicated. In order to protect simple dislocations and sprains from stiffness and further injury, the thumb can be strapped or the finger can be hitched to its neighbor with elastic. The most common example of a ruptured tendon is the mallet finger. A more disabling injury, although not very common, is avulsion of the middle slip of the extensor tendon. Early diagnosis is not easy because of the swelling and slow separation of the lateral slips. In rheumatoid arthritis, where tendons give way and extensors of the fingers part near the wrist, surgery is recommended. Where bruising under the nail becomes painful, a hole should be drilled in the nail to release the blood. A crushed hand should be dressed and elevated in order to avoid "frozen hand." The dressing should be removed often to allow as much exercise as possible. To achieve healing without infection, in open injuries, a dressing

should be applied and an injection of penicillin given to the patient. Bruised and ragged tissues should be trimmed. If the skin is under tension, the wound should not be sutured; instead skin-grafting is required. In cases of exposed bone, cartilage, or tendon where a flap-graft is required, these can be obtained from the hand itself. If larger flaps are needed, they must be secured from another source. Where the fingertip is lost, amputation is recommended. When an extensor or flexor tendon is cut, proper repair leads to a regeneration of nerves. Swelling of an injury can lead to lasting stiffness; dressings should be applied firmly and kept in place by crepe bandages. These dressings should not be changed too frequently until the wound has healed.

Medical Application of Hypnosis. Maurice E. Bryant. Northwest Med. 58:1411 (Oct.) 1959.

Hypnosis is not to be thought of as a cure-all. It is merely another tool to be employed in the practice of good medicine. In the general practice of medicine, hypnosis and psychiatry can be used to advantage. Hypnosis has been used with excellent results in removal of mental blocks to learning, in neurodermatitis, in bed-wetting, etc.

Gratifying response has been received in the use of hypnosis on patients with asthma, especially if the asthma has been precipitated by tension. It has been used successfully in treating insomnia and obesity. In surgery, hypnosis has been found to be too drawn out. Chemical anesthesia is much simpler. However, it can be used in conjunction with chemical anesthesia since patients are often required to hold an extremity in a particular position. Negative suggestions made in the operating room are extremely dangerous, since the depths of unconsciousness are not easily determined. In summary, hypnosis has many applications in surgery and the general practice of medicine. Every doctor of medicine should know how to use the power of suggestion which is the essence of hypnosis.

Use of Hypnosis in Obstetrics. Seymour Hirschman. Northwest Med. 58:1409 (Oct.) 1959.

Hypnosis has been accepted readily as an obstetric technic in the search for ways of making labor and delivery more comfortable. Advantages of hypnosis in obstetrics are that most anyone can induce an hypnotic trance; an obstetric agent, hypnosis reduces the possibility of respiratory and circulatory depression in the mother and fetus with resulting anoxia. By virtue of reduction or absence of a chemical agent, safety is advanced. Fatigue on the part of the mother is reduced and exhaustion is avoided since the hypnotic trance raises the resistance to muscular exertion. In patients for whom chemical anesthetic agents are either contraindicated or hazardous, hypnosis is an improvement. The uterine activity is not depressed by hypnosis. Time factor is reduced which is advantageous both to physician and patient. Since the patient is comfortable during labor, she does not require constant attention; labor is shortened under hypnosis. There exists a lack of increased inoperative interferences or of augmented danger to mother or baby due to increased instrumental manipulation. Post-operative comfort is experienced by the mother.

Disadvantages of the procedure and study of hypnosis in obstetrics is retarded by virtue of the cultural taboos existing because of association of hypnosis with charlatan and misconceptions not yet erased. Time element involved is a deterrent. Originally the physician had to spend many hours training the patient to go into the trance. Newer technics have been evolved and utilized so that now the time involved is very often less than that needed by the physician who does not make use of hypnosis. Since many patients do not understand hypnosis and have preconceived ideas, a period of orientation is necessary. In the training program, the discussion of the different levels of the state of trance is important. Some patients enter only a light trance and then deepen it. It is necessary that the patient understand that under hypnosis she can utilize her education so that she can use reduced amounts of anesthetic agents. In teaching the patient to go into an hypnotic trance, it should be understood that she can enter a light hypnotic state within a few minutes and once this has been induced, can be taught many things.

Basis of Hypnosis. Milton H. Erickson. Northwest Med. 58:1404 (Oct.) 1959.

To approach the subject of the usefulness of hypnosis in medicine, it is necessary to consider the role of psychologic forces in human behavior. In the practice of medicine patients often use their psychologic forces to rule, govern or to control physiologic phenomena. Experiential learning, which is absorbed in a life-time of experiences, is also important. The unconscious mind or the reservoir of learning is utilized in hypnosis. In the practice of hypnosis, the patient is made to become interested in ideas, memories, understanding or a concept of any kind and as he deals with these, he can develop understanding. To understand hypnosis, it is important to understand projection of memory which is done when dreaming. This phenomenon may be defined as the state of ordinary awareness, but it is devoted primarily to the consideration of ideas in themselves with full attentiveness to the idea. In the hypnotic state, the sub-

ject is susceptible to ideas and accepts them. Hypnosis can be defined as a state of receptiveness to ideas and the appraisal of their inherent value and significance. The idea can either be accepted or rejected by the subject, who responds in terms of experiential learning. Trance induction is accomplished by asking the patient to give attention to one particular idea. This attention is centered on experiential learning. The trance is induced by directing the patient's attention to processes, memories, ideas and to concepts which belong to him. The three levels of trance behavior are: light, medium and deep. They vary with the individual subject and need of the situation. Any normal person is hypnotizable but has the right to go into a trance with his own choice of operator. It has been found possible, though difficult, to hypnotize mentally ill and feeble-minded individuals. Of great importance is the personal relationship established between the operator and the subject. Increased muscle tonicify, where the arm can be lifted by the subject and it remains in the same position indefinitely, is one of the first phenomena noted in hypnosis. Under hypnosis, time has a different subjective value. Ideomotor activity is utilized in hypnosis. Ideosensory behavior or the idea of sensation is noted when the operator gives the patient the idea of a particular sensory state, since all hypnotic phenomena are derived from learnings experienced in everyday life. Posthypnotic suggestion, or suggestion given now to be carried out in the future, is another phenomena. Regression or the establishment of long-forgotten memories is utilized in hypnosis. Finally, in hypnosis, the ablation of memory is used as an aid in helping the patient to forget pain.

Hypertonus and Physical Therapy. J. H. Crosland. Cerebral Palsy Bulletin **6**:34 1959.

This paper restrains itself to the effects which physical therapy may have on hypertonus of muscle and thus on the function of a limb or other body part. As in other pathological conditions, the aims of physical therapy when applied to hypertonus are to improve function to the greatest possible degree and to prevent deformity. It is obvious that this form of therapy cannot cure hypertonus but it can ameliorate its degree. Moreover, physical treatment can modify the disability which the hypertonic muscles produce in the function of the limb or body part which contains them. In summarization, physical therapy can modify hypertonus per se. It can to a variable extent modify the effect that the hypertonic muscle has on limb function. Physical therapy can increase the power of hypertonic muscle once the hypertonus has been modified.

Teaching Imbeciles Industrial Skills. Ann Clarke. Cerebral Palsy Bulletin **6**:14 1959.

This article briefly reviews a number of studies concerning the trainability of imbeciles. It endeavors to be indicative by directing the reader's attention to some of the practical and theoretical implications arising from this work. It is hoped that this account may induce those working with the cerebral palsied. Traditionally, the problem of industrial placement of normal people has been considered in terms of selection rather than training, and to this end a great deal of valuable research has been carried out with excellent results for the industries concerned. Inevitably, rejection of a varying number of people who fail to indicate specific aptitudes for particular jobs results from this process. Thus, in industrial selection the emphasis has been on the individual as he appears during a few hours of assessment, which with normal people will have considerable prognostic validity whether it be on industrial, military or educational tasks. It can be seen from all evidence presented why the traditional clinical viewpoint has been in a sense both correct and incorrect.

Closed Treatment of Herniated Intervertebral Lumbar Discs. Darius Flinchum. J.M.A. Georgia **48**:461 (Sept.) 1959.

Because the painful back is complex, its diagnosis and treatment must be cautiously approached. If the intervertebral disc is ruptured or bulges, then it is safe to assume that it is caused by back and leg pain. An important function is served by the disc, a viable unit of the spine. It serves as a cushion so that the spine may move in all directions. It is possible to have a herniated intervertebral disc without any symptoms being present.

The initial treatment should be conservative and it is well to remember that in chronic cases, the attacks are milder and less frequent. Methods for treating herniated intervertebral disc are (1) flexion rest; (2) muscle relaxants; (3) manipulation under a general anesthesia; (4) traction; (5) flexion exercise and stress and (6) plaster flexion corset to be worn approximately six weeks. Rest is the most important of these. If the aforementioned treatment fails to bring relief, then surgery is indicated. No improvement may be anticipated with this method, if the disc is completely ruptured out free in the spinal canal or if it is an old settled disc.

Prevention of Pulmonary Complications in Infants with Tracheotomy by Modification of the Tracheotomy Cannula. Arthur Winter, and Edwin Gilmore. New England J. Med. **261**:482 (Sept.) 1959.

In performing a tracheotomy on an infant, when the metal cannula is too long, it can

pass into the bronchus causing an obstruction. Two case reports are given. In one infant the conditions were recognized and corrected but in the other patient, death resulted. Since the distance between the cricoid cartilage and the carina differs with age, it is best to have roentgenograms of the chest made before the operation is performed so that the proper length cannula can be used. If the tables put out by the manufacturers of tracheotomy tubes are used without preliminary cautions being taken, the results can be serious. In underdeveloped children or extremely young infants, a tracheotomy cannula which has been shortened along the greatest curvature is recommended.

Myofascial Syndrome With Trigger Mechanisms. Karl W. Erwin. Texas J. Med. 55:747 (Sept.) 1959.

Symptoms and signs occurring in individuals who experience painful disorders in the fascia or skeletal muscle are called "myofascial syndromes." However tumor, infection or injury can result in the same clinical picture. This syndrome may be acute or chronic and is accompanied by regional pain, muscle spasm, tenderness, limitation of motion, changes in posture, etc.

Myofascial syndromes with trigger mechanisms are often unrecognized. Their diagnosis involves physical stimulation of the trigger, which reproduces the pain syndrome. Treatment measures are sustained pressure, dry needling, massage, ethyl chloride spray, ultrasound, injection of saline solution and/or a local anesthetic drug. There is a definite tendency for recurrence.

Structural Organization of the Motor Nerve Endings in Mammalian Muscle Spindles and Other Striated Muscle Fibers. C. Coeurs. Am. J. Phys. Med. 38:166 (Aug.) 1959.

It is now recognized that there are two motor systems within a muscle, the small fiber system innervating the muscle spindles and the large fiber system innervating the rapid contracting muscle fibers. Using the histochemical technic for cholinesterase described by Koelle, the author is able to demonstrate the multiple and expanded motor nerve endings in the muscle spindles and the limited zone of motor endplates situated at the midpoint of the fiber in the extrafusal system. This system of staining also demonstrates the absence of cholinesterase activity in the area of sensory innervation in the intrafusal fiber. This is in the area of the nuclear bag which is covered by the annulospiral type of nerve endings well demonstrated by methylene blue vital staining. Also of interest is the high degree of cholinesterase activity at the terminal endings of the flower spray arborizations. It was formerly believed that these endings were of sensory function but because of these findings Coeurs suggests they are motor endings.

Paraplegia in Children. P. L. Norton, and J. J. Foley. J. Bone & Joint Surg. 41-A:1291 (Oct.) 1959.

This paper is a review of 65 children with paraplegia followed for as long as 10 years. Forty-eight of the patients were congenital paraplegics and 17 were acquired. The authors were primarily concerned with the orthopedic problems which developed and the functional status of the patients. All of the group with congenital paraplegia had a diagnosis of spina bifida. Forty-four of the 48 patients had defects including the entire sacrum with approximately one-half of the group having their lesion extending through the third lumbar vertebra. Orthopedic defects requiring surgical correction were considerably more common in these children than in adult paraplegics, especially so in the congenital group. Three of the patients in the congenital group required spinal fusion. There were 27 dislocations and 19 subluxations of the hip, 14 of which required hip-stabilizing operations. Release of hip flexion contractures was the most common operation with 20 procedures of this type performed.

The authors stressed the dangers of passive stretching of the knees in paraplegic children. The hazards include epiphyseal damage, fractures about the knee and subluxation of the knee. In the acquired paraplegia group there was considerably less surgery performed, probably because of the relative maturity of the skeleton before onset of the paraplegia. Ten of these patients were 14 years or older at the time paralysis occurred. Only nine of 48 congenital paraplegics were not ambulatory while in the acquired group six of 16 were not able to ambulate.

Vertical Writing with Eyes Covered. Tadachi Fukuda. Acta oto-laryng. 50:26 (Jan.) 1959.

The author describes a new test for vestibulo-spinal reaction. The patient is first asked to write a number of letters vertically with the eyes opened and without touching the table with his arm. After that the patient is blindfolded and the test is repeated. In people with normal labyrinth function only a deviation less than five degrees can be noted. If the deviation is between 5-10 degrees there is a suggestion of lesion of the labyrinth. A deviation of more than 10 degrees is definitely abnormal. When nystagmus is produced by rotation or stimulation with cold water the vertical writing test shows deviation in the direction of the slow pace of the nystagmus.

Deviation showed up even before nystagmus occurred which made the test a very sensitive one.

The deviation of letters is explained as a result of changes in muscle tonus in the upper extremity which is caused by impulses originating from the labyrinth and passing through the vestibulo-spinal tract. The test gives valuable information in cases of vertigo of labyrinthine origin. It is also found positive in patients suffering from various labyrinthine diseases. Finally, it is indicated in cases of cerebellar and intracranial diseases. In these cases adiadokokinesia is represented by derangement of the letters.

Accident-Proneness in Motor Vehicle Drivers. R. D. Davis, and P. A. Corley. Ergonomics **2**:239 (May) 1959.

This study was undertaken to determine whether accident-prone drivers showed personal qualities or medical disabilities not found in safe drivers, as is indicated from the literature on this subject. The study group was made up of 59 drivers selected from the police records in Cambridge, England, as having been involved in one or more accidents since 1946 and 67 drivers who had competed in safe driving contests. These drivers were then artificially placed in "safe" and "accident-prone" groups depending on whether they had had less or more than three accidents per 100,000 miles. They were also grouped as to the type of driving they did, i.e., private, professional cars, delivery trucks, etc.

Information about the subject's driving experience, personal history, medical history and attitudes on traffic problems, roads and accidents, was obtained from interviews. Visual acuity, stigmatic defects and binocular field of vision were also determined by suitable tests. The results were disappointing in that there were no real differences between the "accident-prone" and "safe" driver groups. As expected, the private drivers had the most accidents, 3.8 per 100,000 miles, while the drivers of gasoline tank trucks had the fewest accidents, 0.6 per 100,000 miles.

Vocal Aging. E. D. Mysak, and T. D. Hanley. Geriatrics **14**:652 (Oct.) 1959.

Average pitch, pitch sigma (degree of variability from the average pitch) and speaking rate were measured with high fidelity recording and analyzing equipment in three groups of men representing average ages of 48, 73, and 85 years. Average vocal frequencies in oral readings for the middle aged group, the 75 year olds and the men with an average age of 85 were 110, 125 and 142 cycles per second respectively. In impromptu speaking the frequencies for all three groups were approximately 5 cps slower. In addition the oldest group showed a considerable increase in the pitch variability which probably explains the quavering quality of the aged voice. The authors suggest three possibilities to account for pitch changes with age. Physical changes in the vocal equipment may take place, emotional and psychological social factors appear which probably cause increased general tension or pitch changes may result from a combination of the two.

The rate of speech among the three groups also showed distinct differences. Oral reading declined from 172 words per minute in the middle aged group to 138 words per minute in the 74 year olds and to 124 words per minute in the oldest group. However, the impromptu speaking rate showed no such steady decline. Utilizing the data from the present report and also evidence from a previous study by one of the authors (Hanley), they postulate what physical and psychosocial changes take place to alter the pitch and speaking rate during aging.

The Treatment of Cerebral Palsy in Mentally Retarded Patients Using High-Frequency, Low Voltage, Electric Currents. Cyrus W. Stimson. Am. J. Ment. Deficiency **63**:7 (July) 1959.

The use of high frequency waves in the treatment of the spastic mental defective was reported on in 1957 by Berman, et al. They applied a so-called sedative action or "sedac" current to the heads of 13 patients and to the head and involved extremity of two patients and, noted improvement in the degree of active motion which occurred spontaneously in the involved extremities. It was also felt that there was some improvement in the overall behavior and responsiveness of the treated patients. Published later, these changes were explained by "Hughlings Jackson's theory of compensation, where some other area of the brain will take up the function of the damaged area." Further evaluation of the use of this type of current was made as another possible modality in the treatment and management of spasticity, whereas 23 mentally retarded patients who also showed some degree of cerebral palsy were chosen. Fifteen members of the group were treated according to the methods by Berman, et al; the other eight were controls who were treated by the application of electrodes to the head but who received no current. The results were five out of 15 experimental and two out of seven remaining control subjects showed minimal functional improvement; the remaining 15 subjects showed no such change.

Surgical Treatment of Cervical Osteoarthritis. Robert W. Rand, and Paul H.

Crandall. California Med. **91**:185 (Oct.) 1959.

While medical and surgical correction has not been used on cervical osteoarthritis, it has been used on cervical spondylosis. These bars of hard bone press on the anterior spinal artery and the spinal cord parenchyma, which causes local neurone degeneration in the anterior horn as well as involvement of the long ascending and descending motor and sensory tracts. Among the symptoms are excrutiating radicular arm pain, numbness or weakness or a combination of these, plus chronic neck and shoulder pain. This shoulder pain is usually referred to as the medical border of the scapula and is often associated with limitation of movement and stiffness of the neck. Cervical spondylosis sometimes involves the entire cervical region, but usually it is more localized by its appearing between the fifth and sixth or the sixth and seventh cervical vertebrae. While it is true that cervical spondylosis is most frequently found in the middle and older age groups, nevertheless, many individuals (particularly males in their twenties and thirties) may show localized disc disease of the lower cervical vertebral segments. "Wear and tear" have been credited with the primary cause of cervical spondylosis. However, degenerative disc and osteophyte formations are the same in a man of 30 as in a man of 60. By anterior disc removal and interbody dowel fusion, approximately 42 patients had complete relief of the neck, shoulder and arm pains and five had partial relief. These patients made a more rapid recovery from the operation than do patients after cervical laminectomy. Other physicians have not had as much success with surgical treatment of this disease. The prime concern is damaging of the nerve roots and spinal cord. It is suggested that all patients with severe neck, shoulder and arm pain syndrome and those with signs of spinal cord disease be most carefully screened for the cervical spondylosis form of osteoarthritis. In summary, the early results of anterior cervical intervertebral disc excision and fusion (Cloward operation) together with removal of associated arthritic bone spurs pressing on nerves and spinal cord give promise of relief of pain and muscle weakness in patients who have this form of cervical osteoarthritis.

Pathologic and Anatomic Factors in Back Pain. Paul Reith. J.M.A. Georgia. **48**:516 (Oct.) 1959.

In the past, local back pain caused by pathologic and anatomic factors has not been significant. Often associated with symptomatic back pain are lesions of the kidney, uterus, rectum, pancreas, intestines, etc. Primary fibrositis and fasciitis may occur in posterior cervicobrachial of lumbosacral fascial layers. It is felt that the primary pathologic factor is immobilization, causing slow return of blood and stasis. Degenerative changes of intervertebral discs and vertebral column joints rate special mention since they constitute the numerical majority of pathologic spinal lesions. Degeneration of the disc can be induced as pressures atrophy. Those disc spaces subjected to greatest pressures, widest range of movement, and greatest posterior compression and shearing forces show degenerative changes early and more advanced. It is known that excessive functional strain can resolve in appearance of degenerative changes in joints and intervertebral discs. Relationship of disc degeneration, collagen disease, disc calcification and fibrositis has been referred to but is still uncertain and doubtful. To summarize, degenerative changes of intervertebral discs and joints are evidence of the wear and tear phenomena of aging.

Movement and Pain in the Treatment of Injuries. Ruscoe Clarke. Medical World **91**:203 (Sept.) 1959.

After minor injuries, it has been found that physical treatment is of great help. It is often prescribed and carried out without really appreciating how it works. The use of massage for a deep muscular bruise and putting a sprained ankle into use by walking or running on it immediately has been experienced by most of us. It has been found that the less severe the injury and the more likely the lesion is to get well in time anyway, the attitude of the individual to life and work speeds recovery with or without specific treatment. Athletes are more interested in how long it will take them to get back to full exercise than they are in the amount of pain or discomfort to which they are subjected. Even in severe injuries, total rest is not the answer; rather, active exercises are indicated. In major fractures, plaster protection allows earlier use of the injured bone. However, for difficult long bone or major joint fractures, open surgery and internal fixation is most often used. In relatively minor injuries movements are harmful; the torn tissues then need surgical repair. While massage and heat assist in relieving pain and facilitating movement, actual movement itself is the best form of making a more rapid recovery.

Changes in Human Muscles after Permanent Tenotomy. S. Sunderland, and J. O. Lavarack. J. Neurol. Neurosurg. & Psychiat. **22**:167 (June) 1959.

Human muscles that are sectioned at amputation, atrophy from disuse but do not lose the morphological features that characterize muscle tissue. The atrophy is reflected by a reduction in the size and weight of the muscle. The extent of the atrophy is related inversely to use of the muscle after tenotomy.

A muscle that is made functionless by tenotomy may lose from 39 to 69 per cent of the preoperative weight. If function is only curtailed, a 16 to 28 per cent weight loss may result. On histological section the caliber of the muscle fiber is reduced and the amount of sarcoplasm is diminished. The extent of fiber atrophy varies from fiber to fiber, and the cross striations are preserved. Patchy areas of degeneration are present but are not characteristic. The connective tissue is also reduced in amount but to a lesser extent than the muscle fibers. A relative increase in the connective tissue is the result. Neuromuscular spindles and intramuscular blood vessels and nerves are not altered by tenotomy. These results were obtained from post mortem examination of a patient who had a wrist disarticulation 20 years prior to death and a patient who had a mid-thigh amputation 10 months prior to death.

Space Medical Research. Hubertus Strughold, and Otis O. Benson, Jr. New England J. Med. **261**:494 (Sept.) 1959.

It is ten years since space medicine officially was introduced. Now two basic types are in existence — 1) orbital velocity and 2) escape velocity. With reference to historical significance, the first manned space flight will no doubt eclipse the successes with unmanned vehicles which presents a challenge to medicine. Four research areas are covered to demonstrate space medicine progress: biophysics; space cabin environment; biodynamics in space flight and selection and training of candidates. Space is made up of thinly dispersed gaseous matter, and dust particles crisscrossed by meteorites of all sizes. The earth on the other hand is made up of dense gaseous matter free of meteorites and permeated by mild radiations. At 120 miles, the "mechanical border" of the atmosphere is reached; beyond this point the environment of space is entered. Regional variations of corpuscular and electromagnetic radiations called radiation belts exist and this is a matter of concern from the standpoint of manned space flight. It is known that orbital flight below the 500 mile level will offer no serious radiobiologic problem. Protective measures must be considered in more extended space operations such as choosing polar regions as exit and re-entry routes as well as attainment of higher velocities to shorten time of exposure and to provide shielding. There is a zone in the solar system in which heat radiation is not too different from the earth's distance; however, on both sides of the zone, there are extremes. As far as the temperature control of a space cabin is concerned, it makes a great difference whether the vehicle stays in the earth-moon region or whether an excursion into the torrid sun or weakly irradiated space beyond Mars is intended.

The presence of meteorites are a hazard in space, not so much individually, but in that meteor streams form which move in the orbits of disintegrated comets. Ecologic conditions on the Moon and Mars are very severe, requiring astronauts to wear pressure suits or at least to utilize oxygen equipment with pressure breathing. The crew taking a trip to the celestial body must be in a completely sealed cabin which will provide all respiratory and nutritional necessities, as well as afford protection against external factors including radiation and meteorites. As far as water supply is concerned it is not necessary to take along all the water needed for a long trip, since the human body gives off about 10 per cent more water than it absorbs. A small amount of water will suffice because more will be produced physiologically during the trip. Space flight involves the application of great thrust and high acceleration in initiating the flight. It has been determined by engineers that the angle of descent is a critical consideration in manned space flights with predicted narrow margins of safety. Human tolerance to acceleration is determined by body distortion and blood shift. It is improved when distortion is prevented as by body positioning and by various forms of support. Weightlessness in space flight is not a function of the distance from the gravitational center of earth, but is the result of motion dynamics in space. In space flight, vision is the cardinal sense for orientation in reduced gravity states. The first flight sent to space will be hazardous and stressful. Astronauts will be selected based on an examination of the individual's tolerance to the physiologic and psychologic stresses of "high-performance" flight. The early astronauts will also be pilots with important tasks to perform such as making important observations and necessary decisions, as well as possessing a superior tolerance to physiologic and psychologic stresses. Among the benefits gained from space medical studies are the state of weightlessness which will enable us to learn more about hemodynamics, by eliminating gravity we are able to understand better the exteroceptive and proprioceptive function of the mechanoreceptors and "gravireceptors", such as the otolith organ nerve endings in skin, muscles and connective tissue, etc.; the microscopical picture of the impact of ionizing radiations; metabolism and nutritional requirements of the human body, and the physiology of the day-night cycle and psychophysiology of sensory deprivation and confinement.

Procto-colitis in Relation to Ankylosing Spondylitis. Ronald G. Grainger. J. Fac. Radiologists **10**:138 (July) 1959.

Intrapelvic infection is suggested as a cause of bilateral, nonsuppurative, destructive sacroiliac arthritis and may be a precursor of classical ankylosing spondylitis in genetically and

constitutionally predisposed individuals. The etiology of ankylosing spondylitis is unknown, however, a hereditary predisposition for the disease is recognized. The most important diagnostic sign is radiological evidence of sacroiliac arthritis manifested by articular erosions, reduction of the joint space and eventually progressing to complete ankylosis.

The author attempts to prove this hypothesis by presenting the case reports of a number of patients with diseases where there is chronic pelvic sepsis and sacroiliac arthritis or arthritic and osteopathic changes in the ischial tuberosities and symphysis pubis, areas commonly involved in classical ankylosing spondylitis. Diseases reported in the literature and also reported in the author's experience as having bilateral sacroiliac arthritis and/or involvement of the ischial tuberosities and symphysis pubis as well as having a focus of chronic pelvic sepsis are ulcerative colitis, Reiter's syndrome, and paraplegia in the male. Occasionally the above mentioned pelvic bony lesions are seen following acute gonorrhea and during acute pelvic suppuration.

Finally, to indicate the prevalence of chronic pelvic sepsis in patients with classical ankylosis spondylitis, the author quotes the literature. In a controlled study of persons with classical ankylosing spondylitis, 80 to 90 per cent had chronic prostato-vesiculitis as opposed to 33 per cent in the controls. The author suggests that the vertebral venous system may be the means by which dissemination of the pelvic inflammation to contiguous bones and joints occurs.

An Unusual Cause of Acute Respiratory Obstruction. E. Connell McReynolds. Northwest Med. **58**:1417 (Oct.) 1959.

Prompt action and effective corrective measures are necessary in order to prevent disaster in acute respiratory obstruction, where it is an emergency. Interference with proper gas exchange between the alveoli and outside atmosphere is the usual result of such an obstruction. While the available alveoli oxygen decreases, the retained carbon dioxide increases. Two cases are cited where obstructions occurred, both concerned a large piece of meat lodged in the posterior pharynx, partially obstructing the glottis and vocal cords. The sites of upper obstruction extend to and include the alveolar capillary membrane. Causes of lower obstruction include tracheal or bronchial foreign bodies, bronchiolar spasm, and causes of upper obstruction are a relaxed tongue and irritating material such as blood or mucus. It is extremely important that oxygen be administered to individuals with airway obstruction. This may be accomplished by bag and mask or mouth-to-mouth breathing. In order to overcome mechanical obstruction, additional muscular efforts are made increasing the demand on oxygen. It has been found that while the cause of death of an individual seems to be acute coronary occlusion, it is discovered that instead death was caused by an acute respiratory obstruction which could have been removed. Only equipment needed is a probing index finger. In cases of suspected acute cardiovascular catastrophe, the posterior pharynx and glottis should be examined for unsuspected foreign body or bodies.

Effect Upon Monosynaptic Reflexes of Decamethonium and Succinylcholine. I. Peripheral Mechanisms. B. Fujimore; T. Tokizane, and E. Eldred. J. Neurophysiol. **22**:165 (March) 1959.

The monosynaptic flexor and extensor reflex response was studied in the hind limb of the decerebrate cat. The height of the monosynaptic response, recorded at the ventral root, of a test shock delivered to appropriate branches of the sciatic nerve was measured. The change in height after intravenous injection of succinylcholine and decamethonium was followed in time. Both extensor and flexor monosynaptic reflex responses were reduced by these drugs. The reduction was dependent on an intact neuromuscular innervation. No direct central effect was observed. Increased muscle spindle discharge induced by the drugs appeared to be the ultimate peripheral cause of the suppression of the monosynaptic response.

Upper Airway Obstruction in the Unconscious Patient. P. Safar; L. Escarraga, and F. Chang. J. Appl. Physiol. **14**:760 (Sept.) 1959.

The patency of the upper airway was determined in 80 anesthetized, spontaneously breathing patients. Measurements were made in the supine and prone positions with the neck flexed, mid position extended and extended with the mandible pulled forward. The degree of patency in these mentioned positions was recorded as obstructed, partially obstructed or open. In the supine position with the chin flexed all of the patients were totally obstructed whereas with the neck extended and the mandible displaced forward 88 per cent of the patients' airways was open and 12 per cent was partially obstructed. When an artificial oropharyngeal airway was used 98 per cent had open airways. The results in the prone position were slightly less favorable. The obstructing agents were the tongue and other soft tissues just above the laryngeal entrance, which were pushed against the posterior pharyngeal wall when the neck was flexed. The authors list the disadvantages of the prone position frequently used and recommended that the patient be laid on his side with the neck extended and mandible pulled forward if resuscitation were not needed.

Methods of Cooling Subjects with Hyperpyrexia. C. H. Wyndham; N. B. Strydom; H. M. Cooke; J. S. Maritz; J. F. Morrison; P. W. Fleming, and J. S. Ward. J. Appl. Physiol. **14**:771 (Sept.) 1959.

Six subjects, ages 24 to 48, were exercised for 40 to 50 minutes in a room at a dry bulb temperature of 97 F. and a wet bulb temperature of 93 F. The subjects stepped on and off a stool, 24 steps per minute, until rectal temperatures reached 104 F. The subjects were then cooled in one of seven environments of at least one week intervals until all six subjects experienced all seven environments. The fastest cooling rate was produced in an environment containing air at a dry bulb temperature of 90 F. and a wet bulb temperature of 87 F. when water at 87 F. was continuously sprayed on the kneeling subject. An environment containing air at 70 F. and 20 per cent relative humidity at zero wind velocity and without water sprayed on the patient was almost as effective as the higher temperature and the water spray. Immersing the subjects in water at 58 F. up to neck level was much less efficient than evaporative cooling. Shivering in association with peripheral vasoconstriction prolonged heat loss by conduction. The data was extrapolated to a theoretical patient with a rectal temperature of 106 F. and the length of time required to reduce the rectal temperature to 101 F. was calculated. The calculated times are 49 minutes for an environment containing air at a dry bulb temperature of 90 F. and a wet bulb temperature of 87 F. at a wind velocity of 120 ft./min. when water at 87 F. was sprayed on the patient. The calculated time in an environment of 70 F., 20 per cent relative humidity in still air without a water spray was 56 minutes, and the calculated time for the patient immersed in water at 58 F. to neck level was 73 minutes. Oral temperatures were found to be unreliable as indices of changes in body temperature.

Evaluation of the Psychological Effects of Occupational Therapy. Franklin C. Shontz. Am. J. Phys. Med. **38**:138 (Aug.) 1959.

The effectiveness of occupational therapy in promoting a desire for independence and for retaining an optimal level of social adjustment was tested on 10 patients in a chronic disease hospital. The patients had their intelligence measured on the Columbia Mental Maturity Scale; their social adjustment was determined by ward nurses using a check list of 30 items reflecting favorable and unfavorable personality characteristics; their ability in the activities of daily living was measured on a standard activities of daily living form; finally, patient attitudes toward the hospital and treatment were tested by a nine item rating scale. Two groups of patients were given these tests to evaluate the effectiveness of occupational therapy. One group was tested after six weeks of diversional occupational therapy. Their program was then discontinued for six weeks and the tests repeated. Occupational therapy was then reinstituted for six weeks and the patients tested again.

To subtract the negative influence of eliminating a treatment program a second group of patients who had never received occupational therapy was tested. They were then started on the final six weeks diversional occupational therapy program along with the first group and retested at the end of the study period. The results showed that after occupational therapy was discontinued four of the six patients in the first group had a drop in their score on the social adjustment check list. All patients studied had a rise in their scores following reinstitution of occupational therapy. On the attitude scale five subjects showed the expected drop in scores following shut down of the program and all ten patients showed the anticipated rise following initiation of the occupational therapy. There were no real differences found in activities of daily living ratings and intelligence test changes were positive and consistent in all measurement periods.

The Digital Circulation in Raynaud's Disease. M. Medlowity, and N. Naftchi. Am. J. Cardiology **4**:580 (Nov.) 1959.

Studies of the digital circulation in 20 patients with Raynaud's disease were compared with similar studies of 23 normal subjects without vascular disease. Measurements of the digital blood pressure and flow were taken at rest under standardized conditions, after vasodilatation, and after vasoconstriction produced by intravenously infused l-norepinephrine. The ratios between flows and affective mean digital arterial blood pressure were converted in radius equivalents, a measure of intrinsic vascular caliber. The patients fell into two groups. In one group the intrinsic vascular caliber was normal after vasodilatation and at rest the vasomotor tone was increased. In the other group the intrinsic vascular caliber was decreased after vasodilatation and vasomotor tone remained unchanged in the resting state. In neither group was sensitivity to l-norepinephrine increased. Digital vascular obstruction is usually found in the patients with decreased flow and pressure and normal vasomotor tone. Whether the vascular obstruction is a consequence of Raynaud's attacks in a subject with normal vessels or whether vascular obstructions occur first and are followed by Raynaud's attacks is still unclear. The authors suggest clarification of the nomenclature for vasospastic diseases by speaking of obstructive digital arteriopathy, and neurogenic digital arterial spasm. Each can remain unqualified or be qualified with Raynaud's attacks; with acrocyanosis, or both.

Active Treatment of Cerebral Palsy. Henry O. Marsh. J. Kansas M. Soc. **60**:481 (Nov.) 1959.

This paper deals with the work being conducted by the Institute of Logopedics at Wichita, Kansas on cerebral palsy. The Institute was established for the correction of the speech handicap and in the last ten years a total of 427 patients has been examined. At the Institute of Logopedics, the cerebral palsy children represent only a fraction of the total patients. The Institute exists for the correction of any speech handicap, and the majority of speech problems are unassociated with cerebral palsy. Cerebral palsy is being treated in a different way. Previously the treatment was passive and consisted of rhythm exercises practiced passively in time to nursery rhymes; practicing relaxation excluding physical and mental stimuli; full control bracing and little or no surgery. Since motivation is the inner spark starting the human engine producing the power and drive culminating in a physical act or accomplishment, motivation has been established in the cerebral palsied. If motivation is not established, the following reasons are given: 1) The child may be too handicapped, mentally or physically; 2) the therapeutic team may be unable to cope creatively with the situation; 3) the innate ambition and drive to work hard enough and long enough to succeed, may be lacking in the child, and 4) complete parental or custodial bankruptcy of insight may stultify motivation. Many times the parent's optimistic goals far exceed the capabilities of the child. He, the child, has his needs satisfied and doesn't have to put forth any effort.

After establishing head control, the child is much more cooperative and workable. In the new method of treatment, passive physical therapy has been discontinued and replaced by active physical therapy. While full control bracing technic is employed in many clinics, it proved unsatisfactory at the Institute since the child was frustrated due to the fact that the braces encased him. When a child is fully braced, he is unable to grasp the basic principles of body balance, hand pressure on canes or crutches and the simple concept of foot thrust against the floor. Physical therapy measures employed at the Institute are active exercises for muscles involved; stretching of tight or contracted muscles; supervised daily practice with physical therapy equipment, and teaching in a logical and progressive manner the physical accomplishments which become increasingly more difficult. In order to motivate self propulsion, it may be necessary to contrive a play situation. Satisfactory results have been obtained by having children act out TV western programs. Another play situation is the construction of a fort from a large corrugated carton. The fort is placed on the floor surrounding the child who propels himself through the gate to see what the Indians are doing. The teaching of sitting balance is actually complicated for the cerebral palsy child because of the many different normal positions of sitting. After the child has achieved sitting balance, then he is ready for standing practice. Heretofore, upper extremity training was relegated to the occupational therapists and lower extremity training to the physical therapists. It is believed that as the child develops greater proficiency in dressing himself, he will achieve greater skill in holding a crutch for walking. By the same token, sitting balance taught in physical therapy will permit more proficiency at a typewriter in occupational therapy. It is the general feeling that bracing has been overdone. Very often full control braces are necessary for a severely handicapped child, but it has been found that the child reacts to braces with complete frustration caused by the belief that the "wooden soldier" walking will be permanent and that he may be mesmerized into believing that this is walking and be quite happy with walking in "robot" fashion.

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